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PREPARATORY WIRING.

It is safe to say that no large building is now erected in the United States without provision being made in it for electric lighting. At any rate, this is absolutely true of all new construction in the business centres of not only the big cities, but most of the smaller ones down to 100,000 inhabitants. A leading central station manager now informs us that he notes a growing disposition among architects to encourage the introduction of electric wires into domestic buildings. Speaking of a city of half a million people, he says that within the last three years he has seen big flat houses and whole blocks of residences go up without a foot of electric wire in them. This, of course, is due to the desire to make the initial cost of a building as low as possible, regardless of benefits to the occupant. But we are glad to note, with our friend, a distinct change in this respect. We could mention also semi-rural territory, where the electric light company gets promptly after every new house and is practically securing all the new patronage that offers for illumination. That is good policy; indeed, no other should be considered by a progressive plant. If the wires are once in, the battle of introducing electric lighting and power is half fought and more than half won. Architects and builders everywhere should be encouraged to provide for wires and install them.

TELEPHONE INVESTMENT.

The recent increase of its capital stock by the New York Telephone Company from $16,000,000 to $30,000,000 is but another evidence of the extent to which the telephone field is able to employ new capital profitably. Various occult reasons are suggested for this increase, but in the final analysis they resolve into a further proof of the fact that New York City is the best centre in the country to-day for telephone extension. Large as has been the growth in the territory of Greater New York under a wise and progressive administration, it cannot yet be said to represent a fair realization of all the possibilities.

There is going on all over the country a rapid expansion of telephony, within the Bell ranks and outside, but we could see with pleasure the issuance of more definite data as to the results of the investment. We believe that the telephone industry is profitable and is far from having reached the state of arrested development that characterizes telegraphy; but telephone managers are still very chary of taking the public into their confidence. Perhaps when the present fight between "regulars" and "independents" is over, we may see the systematic publication of reports, but to-day they are rare and difficult to obtain. Yet telephone securities are already in the hands of many thousands of investors, whose numbers tend rapidly to increase; and the best thing that can happen would be more publicity all around.

THE NEW GUIDE BOOK.

One of the most noteworthy of the supplementary developments of the bicycle has been its literature of travel. The wheel has not only opened up new pathways for the tourist, but has furnished an endless series of excellent maps and itineraries. You can hardly visit any quarter of the civilized world to-day without being able to secure for it a bicyclist's road map far better than the average of those which were obtainable for military purposes before the wheel came into vogue. Grades and curves, prevailing winds, state of roadbed, nearest houses and inns, all are there, for the benefit of pleasure seekers who now take their exercise awheel instead of afoot.

These guides still left the old Murrays and Baedekers necessary, but the latest evolution is the "trolley trip" handbook, which is most emphatically a sign of the new times. Where the big red-covered volume served its tens, and the oblong road map its hundreds, the trolley-trip guide book meets the needs of thousands. It is a distinctly new departure in literature, yet not so new but that New England and Washington are already represented in its pages. To a woman, Katherine Abbott, is due the admirable productions relative to these two regions, and she must be regarded as the founder of a new school. According to Coleridge, the road the human being travels winds round the cornfield and the hill of vines, but according to Katherine Abbott, if you only stick to the route of the trolley car you can also see far more of the historic and romantic spots than were even contemplated in the philosophy of the old grand tour. This is not only true of Boston and of Washington, but of New York and Chicago, and will soon be true, we hope, of all the great cities of the old world. There are plenty of guide books, but those which are most needed for the future must follow the street car lines.

CHANGING TO 200 VOLTS.

It is evident that the lighting companies of London are having trouble with their customers in the matter of changing from 100 volts to 200 volts service, which is now being generally done. Some of the consumers have offered objection to the change, and the companies in turn have threatened to discontinue their service if they would not allow the change. Recently the president of the Board of Trade received a deputation from eight of the leading London electric lighting companies, who desired to have the board regulation as to the supply of electricity amended so that they could change from 100 volts to 200 volts by agreement with the consumer, or, failing agreement, by arbitration. The present regulation says that no change shall be made in the pressure of the supply to any premises except with the consent of consumer. Mr. Ritchie, for the Board of Trade, admitted that it was not just for a few people to stand in the way of the application of the new system, but that these people were within their rights, and if the board assented to the proposal of the companies they would be overriding the rights which those people possessed. He took the matter into consideration, but in the meantime recommended more conciliatory methods.

AN EMBARRASSMENT OF AMBASSADORS.

There is little doubt that under modern conditions ambassadors are often more an embarrassment than a convenience to the countries they represent. Now that a cable message can convey to a minister the latest wishes of his home government, he ceases to be a personality and becomes more and more a mouthpiece. The helplessness and inutility of the minister when cut off from his cable is but too well seen in the terrible situation now existing in China. When our minister is at last withdrawn from Pekin we shall be just as well able to carry on negotiations with the "effete monarchy" there—perhaps all the better for getting him and his womenfolk out of the way. At this minute all our negotiations with China are carried on by means of the cable, almost as they were with Spain when the last great emergencies of war and peace came. Prince Bismarck put it neatly when he objected to the submarine cable, because on account of it diplomacy could no longer be unctuous.

There are no great ambassadors nowadays. The cable is swiftly killing off the breed. It is simply impossible to conceive of John Jay in England or Gouverneur Morris in France doing their work, as they did it, subject to the modern condition of receiving the last imperative instructions of a president and cabinet in session only five minutes before. That work was individual, personal, distinctive to a degree utterly unknown to-day, and for John Hay now to do what John Jay did at the same court, a hundred years apart, has been out of the question, not from any difference in the quality of the men, but because the existence of the cable deprives the strongest ambassador of initiative and of responsibility alike.

This is not a state of affairs to be deplored. It is a pity to lose such fine figures as Lord Stratford de Redcliffe or Benjamin Franklin from the record of foreign intercourse and international history, but it is altogether better that diplomacy should be direct and immediate rather than unctuous and dilatory. But for the cable, every white man in China would have been killed a month ago. Thanks to the cable, the work of rescue is going on, and all the great questions at stake are being settled by cable, over the heads or under the feet of the ambassadors, as though they did not exist, except as mere prisoners to be set free. The only present use of the Chinese minister in Washington is that of a district messenger carrying cable messages to the White House.

OBSOLETE METHODS OF WARFARE.

We publish this week a very interesting letter from "General Manager," in which that gentleman, the official of a large company, calls our attention to the attacks being made upon electric lighting by what may perhaps be called the method of innuendo. He states of his own knowledge that an item on the "dangers of electric lighting" from some kind of an obscure medical journal is being given wide circulation by certain gas companies, and he urges upon us the duty of retaliation. We are informed that one company is paying for the insertion of such matter at the advertising rate of one dollar per line and is constantly inserting advertisments in the news columns in this way, so adroitly drawn as not to arouse the suspicion of the public as to the fact that they are mere malicious advertising matter. Other companies, it is alleged, are doing the same thing.

That such methods of warfare are obsolete, and that retaliation as suggested is equally out-of-date, seems to us undeniable. It is hard to believe that preposterous ungrammatical nonsense of this kind can attract any serious attention: "Currents of electricity generated and regulated by the amount of battery charge offered no serious danger to the public, but the intense currents generated by modern machinery for motor and light furnishing power is one yet full of terror and dangers. Look, for instance, at the fire losses incurred by defective electric lighting in the last two years. The extension of this character of lighting has created a ratio of death and property destruction in direct proportion to the extension of the terrible and badly mismanaged current." It is, indeed, difficult to imagine that any intelligent manager of a large gas company could relish such rot as this and pay out good money to give it wider publicity that it would enjoy in the columns of what we take to be a mythical publication.

In the early days of electric lighting it was customary to compile such lists of gas accidents and fatalities as our correspondent now proposes. They were a terrible indictment, and it would be just as easy now to get together the same quantity of sensational data, proving, as is pointed out, that gas is very dangerous and often deadly to the public. For example, the last annual report of the Board of Gas and Electric Light Commissioners of Massachusetts, for 1899, states that during the year the board received notices of 102 serious accidents from escaping gas, causing the death of 65 persons and injury to 69 others. Very few were gas workmen, many were probably suicides. In the same period, the board reports five deaths from electricity, four being those of linemen; and there were ten accidents, six of them to linemen. These figures are, we take it, a fair average.

But we had in the early days, and have still, our doubts as to the effect of such data on an intelligent community. The papers teem daily

with accounts of frightful accidents on steam railroads. We question whether any single person every stopped using the railroads on that account, the public in general agreeing with John Bright that the safest place on earth is a seat in an express train. For years New York journals and other newspapers blackguarded the "deadly trolley" till they actually foamed at the mouth, but the trolley is here just the same, a welcome, popular benefactor. We do not believe that the *Lancet Clinic*, if there is such a paper, can do the slightest harm to electrical development, even if its puerile displays of unscientific ignorance are reproduced at the rate of one dollar per line in every daily paper in the country.

The real harm to any art, electrical or otherwise, comes from the neglect, carelessness, parsimony and folly of its own practitioners. Our faith in electricity as one of the greatest gifts to mankind is invincible, but we cannot blind ourselves to the fact that where bad work is done, no agency is more ready to show that it must not be trifled with. There are reasonable rules and regulations enough to insure the utmost safety to life and property, and if qualified workmen under vigilant management carry out such requirements, *Lancet Clinics* can snarl forever in imbecile impotence against that which becomes daily more and more the safest and best means of light, heat, power, transportation, ventilation, the transmission of intelligence and chemical action the world has ever known.

POWER TRANSMISSION AT CONSTANT CURRENT.

To the average American engineer constant current long distance transmission conjures up the vision of an arc machine of ancient pattern running, at much pains of flapping belt and coruscating brushes, a few spark-scarred motors only less incompetent than itself. He looks upon the system as one which, having been at its best a makeshift, and now undeserving even the name of a stumbling block in the path of progress, should be consigned to a resting place in the back attic of oblivion. In view, however, of the foreign work which has perhaps escaped his attention, it is only fair to remark that his picture is hardly of photographic accuracy. The fact is, that in spite of the enormous growth of polyphase transmission work and its undeniable success, constant current transmission is neither dead nor reasonably to be called moribund. It is both curious and interesting to note that right through the last decade there have been installed a succession of constant current plants, now aggregating more than 15,000 horse-power in generating capacity, and about being increased by a 5000 horse-power plant transmitting power some thirty-five miles at a pressure of above 20,000 volts.

The commutator seems to have no terrors for some of the Continental engineers, who have steadily increased the capacity of their constant current units until they have reached an output of three or even four hundred kilowatts at voltages ranging from two to four thousand. All this looks like business, and conveys no idea of a system about to sink into innocuous desuetude. It certainly outrages all our Yankee notions of the fitness of things to see this work going on, but nevertheless it is worth thinking about, for people do not wittingly invest some hundreds of thousands of dollars in out-of-date apparatus. One may buy a few relics out of reverence for antiquity, but hardly wastes his substance upon machinery that is hopelessly superseded. There must obviously be something to be said for constant current methods or they could not persist in the face of the competition encountered on every side, and it is perhaps worth while to consider some of the claims that have been used forcefully enough to get contracts from under the very noses of the earliest champions of polyphase transmission. These claims may be ill or well founded, but they are at least instructive.

Great stress is laid by engineers versed in constant current practice upon the simplicity and security of the lines. Let us see what are the facts in the case. A constant current circuit consists of two wires, carrying a steady, continuous current at a voltage rising to its maximum only at the peak of the load. For the same loss in the line and the same effective voltage, a polyphase system requires at least three wires; and if the energy transmitted is very considerable, due respect for the inductance factor of the line frequently demands six wires. These, moreover, carry the full maximum voltage all the time, with a normal extreme voltage nearly half again as great as that upon the constant current circuit, to say nothing of rises due to resonance. Now, there is little doubt that two wires are normally easier to insulate well and keep insulated than three or six wires of smaller size, and that the line is, on the whole, less likely to break down when it carries on the average a considerably lower voltage. It is impossible to say what practical importance should be attached to the extra strain due to the crest of the alternating wave. So far as puncture is concerned, the danger is no doubt increased, but in the matter of leakage over the surface of the insulators, the electrolytic strain of a continuous current is likely to even matters. At moderate voltages, i. e., so long as there is a very great factor of safety in the insulation, whatever differences there may be are probably of little account, but at, say, an effective voltage of 50,000, we should have with the constant current a true maximum of that amount, and probably an average of 30,000 to 35,000 volts, while with the alternating current the maximum voltage would be about 90,000 all the time, undoubtedly a much severer strain. Of the two lines, the constant current one would work with a much greater factor of safety.

So far so good, but when the Continental engineer, with a brief for constant current, begins to vaunt the simplicity of his generating station, an indefinable something suggests to us, without going through the formality of reasoning, that he is "talking through his hat." Assume, for example, a 5000 kilowatt transmission at 50,000 volts, worked on a constant current system, there would be required 16 to 20 generators, forming, as they are generally coupled in pairs to the wheels, eight or ten generating units. On the polyphase system, the station would consist of but four or five generators working in parallel and each coupled to its own wheel, plus as many groups of transformers. It is not easy to see where the simplicity of the former system comes in, unless one takes the switchboard as an example. There the continuous outfit would have rather the better of the argument. As to the ease of operation, it is certainly quite as easy to add continuous current machines in series as alternators in parallel, but the former would be very perceptibly less efficient, although they would hardly differ enough to offset the loss in the transformers. Consider, however, what magnificent pyrotechnics could be furnished by 20 high voltage commutators. We published recently a very striking photograph of a display upon a high voltage polyphase line, but it would sink into insignificance beside what those commutators could do if really roused to competition. Of course, constant current systems are free from inductive disturbances with all thereby implied, but they assuredly have troubles of their own, not the least of which is the task of insulating the machines from earth—both motors and generators. In these constant current plants abroad, the motors are pretty nearly kept in glass cases, and we judge that precautions of this sort are hardly ever likely to become popular in this country. There is no accounting for tastes, however, and we may get an extensive demonstration of constant current transmission even on this side, although so far as we are aware, no one here is building such apparatus at the present time for long distance work.

The Alaskan Cable.

A special from San Francisco says the steamer Orizaba, belonging to the Pacific Coast Steamship Company, has been chartered by the Government to take and lay the military cable which it is proposed shall connect St. Michaels, Unalaklik and Nome in Alaska.

The Kerite cable, which is now on its way west, is 200 miles in length and weighs a ton to the mile. The Orizaba will leave for the North with the cable about Aug. 25, and actual work will begin about the middle of September. The cable when laid will be under Government control. The primary object of this comparatively short stretch of cable is to put the mining camp at Cape Nome in communication with the rest of the world through a land line and cable system terminating at St. Michaels. From the extreme western end of the system of communication thus created, at Unalaklik, it is no great distance across the Behring Straits to a point on the Siberian or Kamtschatkan coast in communication with the Russian land lines across Siberia. It now seems likely that the northern line, under the pressure of the urgent need for communication, will be completed before any plan for connecting the Hawaiian Islands and China is put into effect. Mr. G. F. Porter, of the Brixey Kerite Company, is accompanying General Greely, of the United States Signal Service, on this work. The line will be equipped with sine-wave transmitters for automatic work, and will also have a Morse equipment for hand work. Current will be supplied by gas-engine-driven generators.

Automobile Races in Chicago.

Tests, races and an exhibition of automobiles will be held at Washington Park, Chicago, under the auspices of the Inter Ocean Publishing Company, from Sept. 18 to 22 inclusive. Prizes will be given to the manufacturer presenting the greatest number of practical designs and to the manufacturer having the greatest number of automobiles in line. A special prize for the most practical design of wagon for general purposes will also be awarded.

On the first day there will be a general parade of vehicles; on the second, tests for general practical utility will be commenced. All forms of power will be classed together, and vehicles at each different rating of power will be awarded prizes and honors in competition only with vehicles of like size. The vehicles entered for practical utility must be of standard design, construction and equipment, and regularly catalogued by the manufacturer for sale. Each manufacturer will be allowed to enter three vehicles in this competition.

In testing the practical manipulation of the vehicles, dummy figures will be laid on the track; there will also be a section of extremely rough and uneven road, with mud, ruts, logs, stones and all sorts of obstructions requiring short stops and turns, and including both up and down grades corresponding to country roads and city streets. In these tests the prizes will be awarded on the following points: Speed, elegance of design and practicability; best arrangement of brake and control of speeds; best climbing of grades; best and surest safety devices for operating vehicles either on the grades or level; best and simplest mechanical construction. There will also be a hill-climbing contest, and a heavy draft contest, open to all heavy draft motor trucks built for commercial hauling. In the latter test, the prizes will be awarded on the following points: Construction, power, carrying capacity, design and control. The prize winners of each class will be allowed open competition on carriage design of practical utility, easiest manipulation, safety and emergency devices, cost of power per ton-mile—the cost of electric current to be based on 4 cents per kw-hour, and of gasoline or oil on the current market price per gallon.

There will be four speed races, each manufacturer having the right to enter two vehicles. The races will include one of 20 miles for steam vehicles, one of 20 miles for electric vehicles, and one of 20 miles for gasoline vehicles. The prize winners of each class will enter a 40-mile race. There will be also a 200-mile race, free-for-all, fast track race for owners, carrying four adults; also a 200-mile track race, carrying two persons.

An important feature of the tests will be a mail race. Four mail bags will be placed at equidistant points around the track, and ten miles will be run, making the four stops for the purpose of collecting the mail. Vehicles accomplishing the results in the shortest space of time will be awarded a first prize and the driver of the same will receive $25 for his personal efforts. An additional prize will also be given for the most practical and best adapted vehicle for the collection of mail from street boxes.

On the fourth day there will be a 500-mile smooth track road race, free-to-all, the award to be on the basis of speed. This will be followed by an automobile transfer express, to be run five miles, taking a swinging bag from suspended hooks at four points around the track without stopping. There will be a ladies' day, on which the ladies will have exclusive use of the tracks in a series of races. A special gold medal will be awarded in this class, and manufacturers or private owners are privileged to enter. A special gold medal will be awarded to the operator of the vehicle which performs the most difficult tests and practical movements. This test will be followed by an exhibition of vehicles owned exclusively by private individuals, which will be open and free for all in a four-mile race. This race will be followed by an exhibition of fancy or trick driving. There will also be a pulling test. A three-mile race will be run by merchants' delivery wagons, having eight stations, at each of which a package must be left weighing not less than 20 lbs. When the races are over, a prize of $1,000 will be offered to the most valuable invention in automobiles that shall have been practically demonstrated during the exhibition week. There will be other special features and runs during the week. There will be a race for automobiles running backwards at full speed for one mile. In these competitions $10,000 in prizes will be offered.

The Status of Wireless Telegraphy.

A recent editorial item in these columns has called forth a letter which appears elsewhere in the present issue, as to what has been actually done with wireless telegraphy. Some further data is furnished by a report of the recent meeting in London of the Marconi International Marine Communication Company, Ltd., an offshoot of the Marconi Wireless Telegraph Company. The chairman, Major S. Flood Page, referred to the attempt to fix on their system a post office license, just as had been done in the case of the telephone, and he said: The Marconi Company could work in defiance of all the post office authorities in the world, who could have no legitimate grounds for interference with the company's operations in any way whatever. If the company fitted their system onto a ship and that ship traversed up and down the English coast, it could speak to half a dozen stations without interference by the Post Office so long as the ship was three miles and a yard away from the coast, and the onus of proof of the three miles and a yard lay with the Post Office and not with the ship. They did not want to quarrel with the Post Office, but at the same time they had no intention of being bullied. He thought he might be permitted to say that the Marconi Company had the sympathy of some of the highest Government officials in this matter. He would give then one instance of this Post Office interference, which he regarded as simply monstrous. They had entered into an arrangement with the Southeastern & Chatham Railway Company to obtain the best instruments possible for communication between their ships and the shore. That company carried over 400,000 passengers a year in their ships, and had not lost a single life since 1863, and the directors were alive to the value of wireless telegraphy. He had asked the manager of the railway why the matter had not proceeded, but was unable to discover whether the block lay with the French Post Office or with the English Post Office, or whether some clauses of the Postal Union Convention prevented their working. He held that it was simply monstrous that English industries should be hampered in this way by the bugbear of a Government monopoly, which, if it had been fought, would, he had legal authority to say, have no longer existed. He had one good thing to tell them, which was that the Marconi Wireless Telegraph Company had entered into a contract with the English navy, which, if succesfully carried out, would stamp the Marconi system once and for all, so that no one could question its merits and advantages. The contract provided that there should be 32 ships or torpedo stations fixed up with the Marconi apparatus, but they did not know the date when they would have to commence their work. The work they had to carry out was a difficult one. A ship was to be fitted at Portsmouth, and another at Portland, and these were to communicate one with the other. It was a long distance, and there was a high range of hills between the two places. They had had the Marconi apparatus at Delagoa Bay on four of Her Majesty's ships for several weeks, and in no case had it failed to give satisfaction. The Portuguese Government at Lourenço Marques were carrying out an installation, and they were expecting full details daily. The system had never failed where it had been properly carried out.

The Service Switchboards of the Paris Exposition, Electricity Building.

THE two switchboards for distributing the current generated in Electricity Building, and utilized all over the Exposition for lighting, power, and other purposes, are located in the central part of the building to the rear of the Chateau d'Eau, and close to the United States section. One of the boards is used for continuous currents, and the other for alternating currents—single-phase, bi-phase and tri-phase. The direct-current switchboard is located to the left, and the alternating-current switchboard to the right, on the wall of Electricity Building, behind the Chateau d'Eau.

The alternating switchboard contains panels for twenty machines, and eighteen distribution circuits are leading from it. Of the twenty dynamos connected to the board, seventeen are three-phase, one bi-phase and two mono-phase machines. In general, the design of the board is such that one panel contains the leads from two machines and also the terminals of two distributing lines. Each of the two machines can thus be connected to either of the two circuits. It has not been possible, however, to carry this principle through entirely in the construction of the board, as there is only one bi-phase machine which cannot be interchanged with any other; and as there are twenty machines and only eighteen distributing circuits, there are necessarily two machines in reserve. The second panel from the left contains

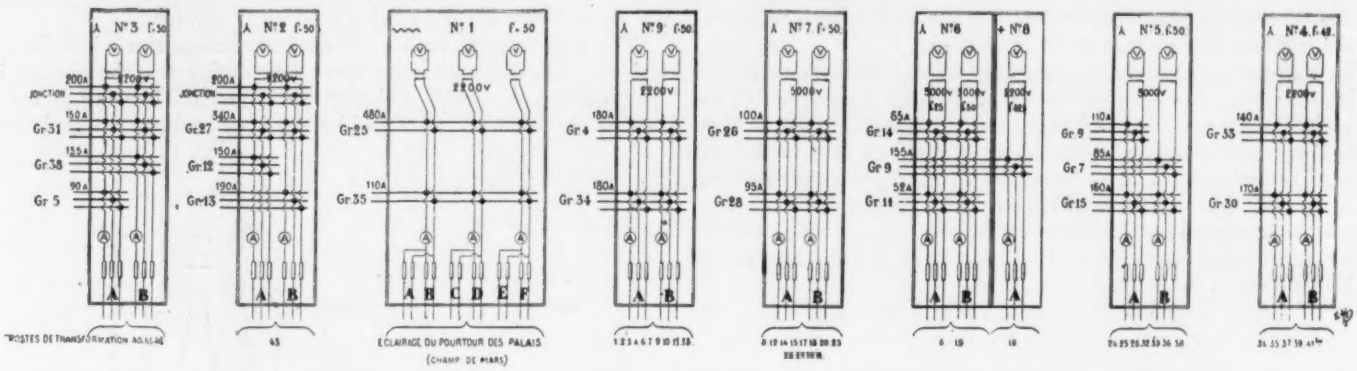
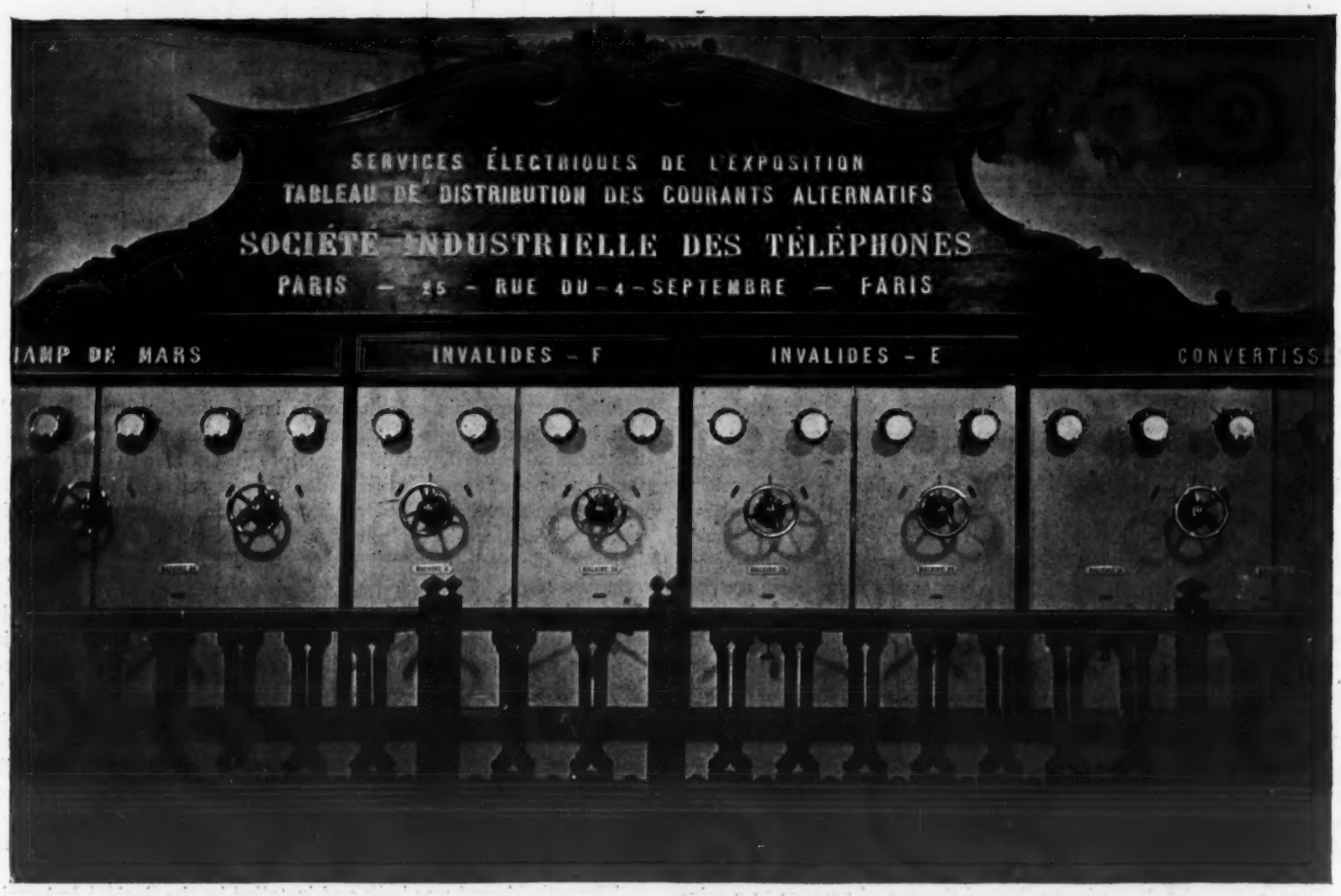


FIG. 1.—ALTERNATING-CURRENT SWITCHBOARD, ELECTRICITY BUILDING, PARIS EXPOSITION.

The electrical distribution system is laid out on the plan that all the near-by buildings are lighted by direct current, while parts of the Exposition, at some distance from Electricity Building, have an alternating-current service. Thus, the Palais de l'Electricité itself, the Agricultural Building, the Palais Suffren, the Palais Bourdonnais, the Salles des Fêtes and the Chateau d'Eau are served from the direct-current switchboard, while the annexes of the Champ de Mars (except the German electrical and machinery annex), the section of the Exposition around the Trocadero, the Esplanade des Invalides, Quai d'Orsay, the Champs Elysées and the Monumental Entrance, are served with alternating currents.

the leads from these machines, and each of the two can be thrown on any one of the four circuits of the Trocadero district. The annexes of the Champ de Mars, where no power is required, are furnished with mono-phase current. For the two machines there are three circuits but these already branch out into six at the switchboard. All the circuits can be connected to either of the two machines, or one circuit may be connected to one, and two circuits to the other machine. The only bi-phase machine is used for operating elevators at the Invalides.

The marble panels of the switchboard are held in place by an angle iron structure, and are surrounded by a wood framing of ornamental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CHAMP DE MARS
INVALIDES - F
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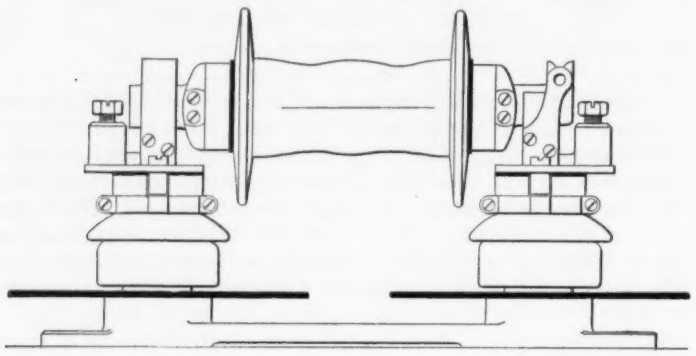
FIG. 2.—MIDDLE SECTION OF ALTERNATING-CURRENT SWITCHBOARD, ELECTRICITY BUILDING.

design. In front of the board there is an elevated platform, fenced in by a neat wood guard railing. The main and throw-over switches are fastened to the rear of the board, and only the operating handles are visible in front. On the upper part of the panels are seen the volt and ammeters. The former are connected between two mains, through the intermediary of a meter transformer, and the latter are placed directly in one of the mains.

The leads from the machines are brought to the switchboard in underground conduits. Here they fasten to the main switches, which are placed the lowest on the board. From the main switches the conductors lead to the throw-over switches, located above the former, and from these they rise to the height of the board, and then cross over to the wall, where they descend again. The height of the conductors, where they pass from the board to the wall, is such as to permit the free and easy passage of the attendants.

The high-tension, fusible cut-outs are fastened to the wall behind the board. The space between the board and wall is not covered, but the switches have a cover of sheet asbestos, which protects them against anything that might drop from above, and also retains the flame of the arc formed on breaking the circuit. The clear space between the switches and the wall is seven feet, and the flooring of the space is supported on porcelain insulators.

The high-tension, quick-break switch employed, is illustrated in Fig. 4. The contact is made between a carbon roller, on the switch arms, and a stationary metal contact, fastened to porcelain insulators. The



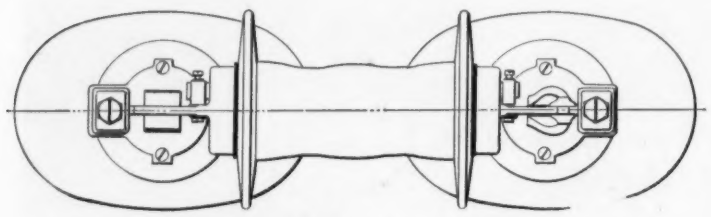


FIG. 3.—HIGH-TENSION FUSIBLE CUT-OUT, ALTERNATING BOARD.

rapidity of the make and break of these switches is independent of the operator.

On the central rod, around which the switch turns, is mounted a loosely-fitting sleeve, with two lever arms, making an obtuse angle with one another. At the extremities of these lever arms, are connected coiled springs, the other end of which fastens to some stationary part of the switch. A finger on the shaft of the operating handles engages with a projection on the above-mentioned sleeve. On turning the switch handles, the sleeve is carried along, and during the motion of the latter, the effective lever arms of the double-armed lever, in regard to the forces of the springs acting upon them, are constantly changing. At first, the lever arm, holding the switch in place, is the longest, but its effective length gradually diminishes, while that of the other lever arm gradually increases. When the lever has passed the point where the effective lengths of its two arms are equal, it jumps away from the finger of the operating handles and, engaging the switch, opens it and carries it to the limit of its motion. The angular motion of the operating handles is 180 degs., and that of the switch arms 90 degs. The length of the double break of the 5000-volt switches is 90 cm, or about 3 ft. The action of the mechanism on closing the circuit is exactly the same.

It is claimed that the rapid break, and the turning of the carbon rollers, reduce the deleterious effect of the arc of rupture to a minimum.

For the three-phase and two-phase machines, three-pole switches are used, while the panels of the single-phase machines are equipped with two-pole apparatus. The switch arms of the various poles are mounted, side by side, on the same shaft, and are separated by an insulating partition.

The throw-over switches, by means of which one machine can be connected to either one of two circuits, are of essentially the same construction as the interrupting switches. They have the same carbon-roller contact and quick-break machanism as the latter, only that instead of two sets of stationary contacts 180 degs. apart, there are three sets, 120 degs. apart; and that the switch arms turn through an angle of 120 degs., instead of through an angle of 90 degs. These throw-over switches always make connection with one or the other of the two circuits, there being no "open" position.

The high-tension, fusible cut-outs are accessories which have received considerable attention from their designer. The aim has been to produce a cut-out in which the arcing on the blowing of the fuse would be a minimum, and in which the fuses could be replaced, quickly

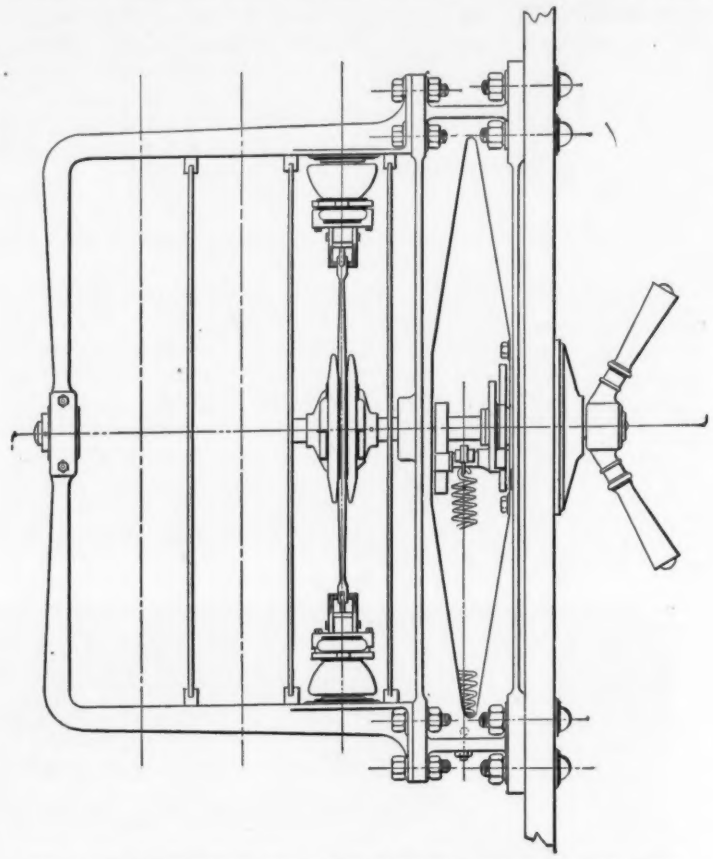


FIG. 4.—HIGH-TENSION QUICK BREAK SWITCH, ALTERNATING BOARD.

and safely, while current is on the line. The cut-outs consist of cast-iron base plates, on which are mounted porcelain insulators with terminal contacts.

A hollow porcelain cylinder, with large circular flanges on either end, has fastened to its ends, metal contact pieces which engage with the terminal contacts on the insulators just alluded to. These contacts are in the form of knife blades, but they are different at the two ends of the porcelain cylinder. The two sides of one of the terminal contacts are joined by a pin, which engages with a corresponding slot in one of the blades fastened to the porcelain cylinder, thus forming a sort of a hinge. In replacing a cylinder, this contact is engaged first. The cylinder is now guided sideways by the two blades of the terminal contact, and endways by the pin, and the electrician will push it into position without hesitation, as there is no danger of missing the contacts. All destructive arcing on replacing a fuse is, therefore, avoided.

The two contacts at the ends of the porcelain cylinder are connected with each other by three-fuse wires, two of which are in the open air inside the porcelain cylinder, and the third in a small glass tube filled with French chalk. The wire in the glass tube is the finest, and it will blow last. The intensity of the current flowing through this wire, after the other two have been melted, is such as to fuse the entire length of the wire almost instantly.

The switchboard was built and installed by the Société Industrielle des Téléphones of Paris, and the price paid for it is 35,000 francs.

The writer is indebted to Messrs. Lelas and Peyré, engineers of the Société Industrielle, for information in regard to this board.

The direct-current switchboard, illustrated in Fig. 5, has 28 panels, each of which corresponds either to a generator or to a distributing circuit. There are, in all, 20 generating sets, the energy of which is controlled by this board. The aggregate capacity of these units is in the neighborhood of 10,000 kilowatts, corresponding to a steam plant of 15,000 horse-power.

The direct-current distribution is on the three-wire, 500-volt system. The 500-volt generators are connected across the mains, and 250-volt generators between one of the mains and the neutral. All the direct-current generators are of one of these two voltages. The generator leads from the foreign section arrive at the left, and the leads from the French section at the right of the board. The distributing mains start from the central panels. All the machines are operated in parallel, and a set of bus-bars runs the whole length of the switchboard. The mains from the machines are brought to the board underground, the same as in the case of the alternating switchboard. On the lower half of the switchboard panels are fastened the main dynamo switches of the bipolar, quick-break type. From the switches the conductors pass upward, and an ammeter is inserted in one of the mains of each machine, and fastened to the upper panels of the board. The conductors join directly to the bus-bars, which extend all the length of the board and are placed centrally above the space between the board and the wall. Opposite the central or distributing panels the distributing mains leave the bus-bars and pass over to the rear of the board. An ammeter is placed in each of the mains, and a three-pole, quick-break switch opens all three lines of one circuit. After passing the switch, the conductors pass beneath the insulated wooden floor to the wall, where a fusible cut-out, or an automatic circuit-breaker, is inserted in each of the mains.

The fusible cut-outs have marble bases, and wood cases with a glass front. All the cut-outs are attached to two iron bars, held by porcelain insulators fastened to the wall. The three main distributing circuits are provided with automatic circuit-breakers instead of fuses. These six instruments have each a capacity of 1000—1200 amperes and they are of the Thomson-Houston type. The circuit-breakers have liberal marble bases, and they are fastened directly to the wall. A sort of asbestos roof is placed over these circuit-breakers to arrest the arc, produced on the opening of the instrument.

Over the space between the board and the wall, there is a superstructure of I beams. Three I beams run from one end of the board to the other, and they are held in position by shorter cross pieces, fastening to the framing of the switchboard and to the wall. From the three longitudinal I beams are suspended by means of intermediary porcelain insulators, the three bus-bars, consisting each of a number of rectangular copper bars of 2.5 sq. cm. cross section. The number of bars, that is to say, the total cross section, varies from the end to the centre of the board, in proportion to the current to be carried. A density of 4 amperes per square millimetre, or 2500 amperes per square inch, has been allowed in the design of the bus-bars. The neutral bus is of about one-half the cross section as the mains.

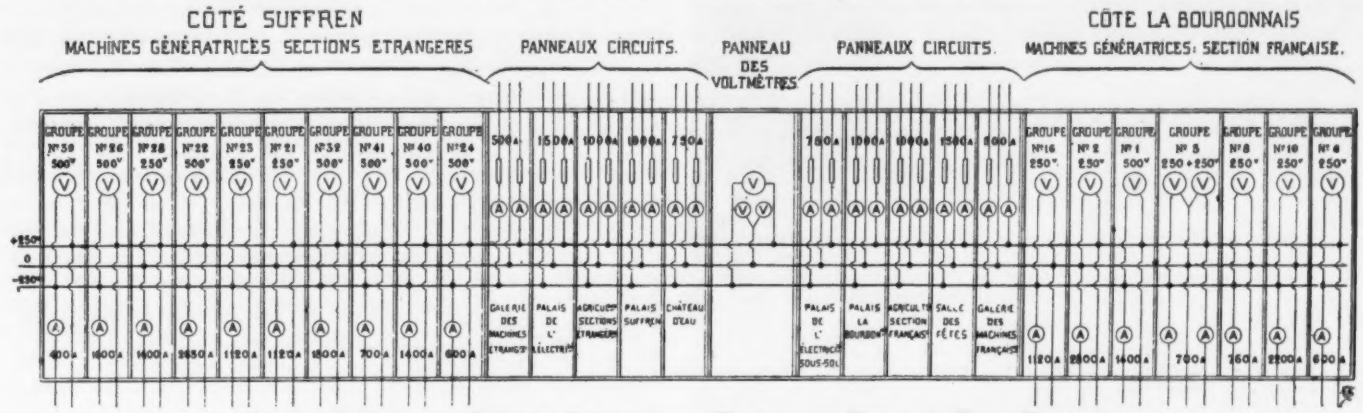


FIG. 5.—CONTINUOUS-CURRENT SWITCHBOARD, ELECTRICITY BUILDING, PARIS EXPOSITION.

The switches are of a special quick-break type. They have a base of cast-iron, and the four or six stationary contacts are mounted each on a separate slab of marble. These stationary contacts consist of castings, holding each two laminated copper brushes placed at an angle towards each other, and a third solid brush at which the break occurs. The pivot supports for the switch arms are insulated from the cast-iron base by washers and bushings of micanite. There are double switch arms, pivoted on the same rod. One of these arms carries the contact blades, and the other one the operating lever. The two arms are connected by coiled springs. In opening the switch, the handle is drawn out, but the contact arm remains in position until the tension of the springs is equal to the friction of the contact, when it will let go and make a very rapid break. To prevent the contact arm from slapping against the handle arm with great force, the former is provided with a dash-pot, which begins to act, once the circuit is well opened.

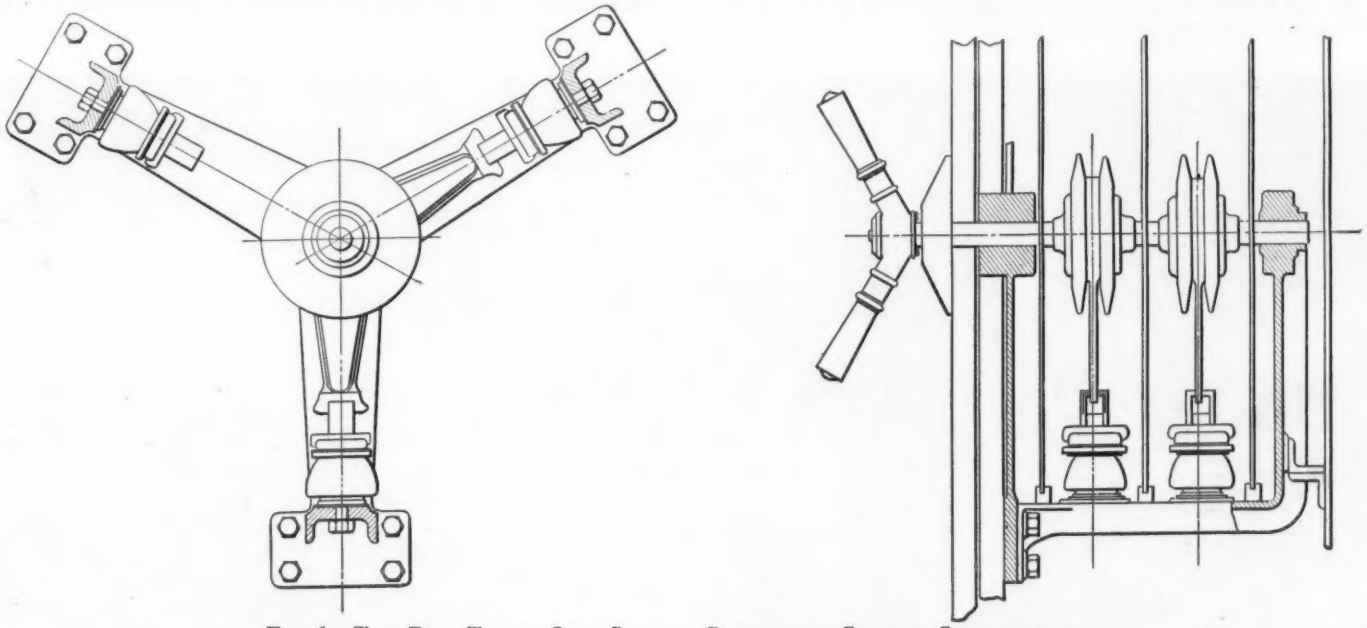


FIG. 6.—TWO-POLE THROW-OVER SWITCH, CONTINUOUS-CURRENT SWITCHBOARD.

The four or six marble slabs of the switches, on which the stationary contacts are mounted, are divided by wooden partitions. The lower half of the panels of the switchboard is in sheet steel, which is cut away where the switches are placed. The upper half is in marble, and carries the indicating instruments. The rear of the board can be reached by a door in the middle of the board, and by doors on either end. There is a wide platform in front of the switchboard, which is fenced in by an iron railing of simple ornamentation.

There is one distributing panel, which is connected to the wall behind the switchboard. This panel serves the German electrical and

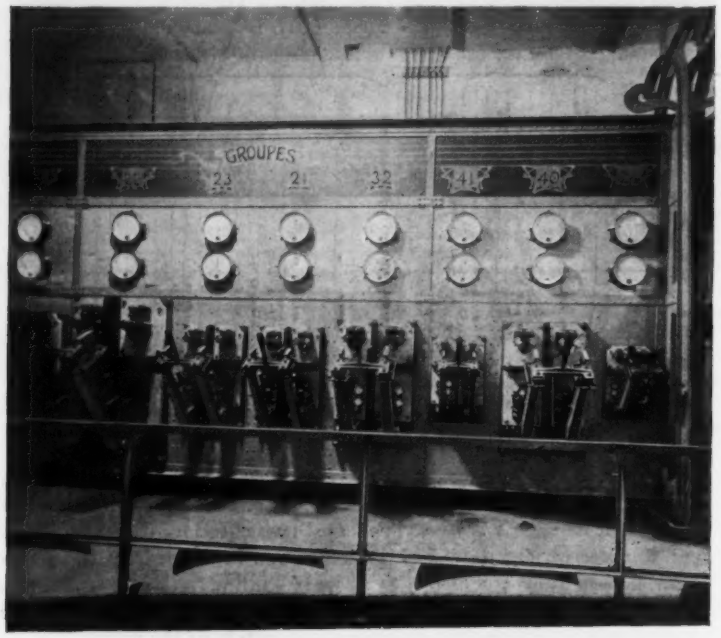


FIG. 7.—TWO SECTIONS OF DIRECT-CURRENT SWITCHBOARD IN ELECTRICITY BUILDING.

machinery annex, where about 500 kilowatts are used for lighting and for driving machinery.

This switchboard has a total length of 112 ft. It was constructed by the Cie Générale de Travaux d'Éclairage et de Force, Anciens Etablissements Clémançon of Paris.

Both of the switchboards have an extra fence at some distance, to keep the public away from the attendants. There is also at one end of each switchboard an office for the technical service, and where the records are kept. The space in front of the switchboards was rather dark during the earlier part of the Exposition, but it is brilliantly illuminated now by arc lights. The photographs herewith shown were taken by the light of the adjacent arcs.

Hutin & Leblanc Compound Exciter at the Paris Exposition.

One of the most novel and interesting exhibits in the French section of the power plant in Electricity Building at the Paris Exposition is the "electrogene" group shown by A. Grammont, of Pont-de-Cherui, France. It consists of a Grammont 600-kw, three-phase alternator at the Paris Exposition. The frequency is 50 p. p. s. The circuits are connected in star. For the power factor 1 the current in each circuit is 144 amperes; for the power factor 0.7 it is 206 amperes. The "ring e. m. f." is 2400 volts efficiency, the "star e. m. f." 1390 volts efficiency. The number of poles is 64. The efficiency is 95 per cent for a power factor 1, and it is 93.2 per cent for a power factor 0.7. The main interest is in the special compound exciter, Fig. 1, by Hutin & Leblanc, of which a description has been furnished by M. Routin to *L'Industrie Electrique*. It consists (Fig. 2) of an ordinary direct-current armature, *A*, subjected to the influence of two independent rotary fields, produced by two stators, *B* and *C*, like those used to produce the rotary field of an induction motor. The winding of the stator *B* is connected across the terminals of the alternator as a shunt, the winding of *C* is in series with the armature of the alternator. A special arrangement allows taking off direct current from the armature by means of brushes, fixed in space. This arrangement has two special features: (1) The winding of the armature of the exciter must be exactly like that of an ordinary machine with *n* brush lines and *n* pole lines (a pole line being a geometrical line between two poles diametrically opposite; also a brush line a line between two brushes diametrically opposite), but all connections between armature and commutator are reversed with respect to *n* axles of symmetry (see below); (2) it is not necessary that the number of the brush lines is equal to that of the pole lines. With this arrangement the sufficient and necessary condition for taking off direct current by means of brushes fixed in space, from the armature which is supposed to revolve in the same direction as the rotary field, is given in an

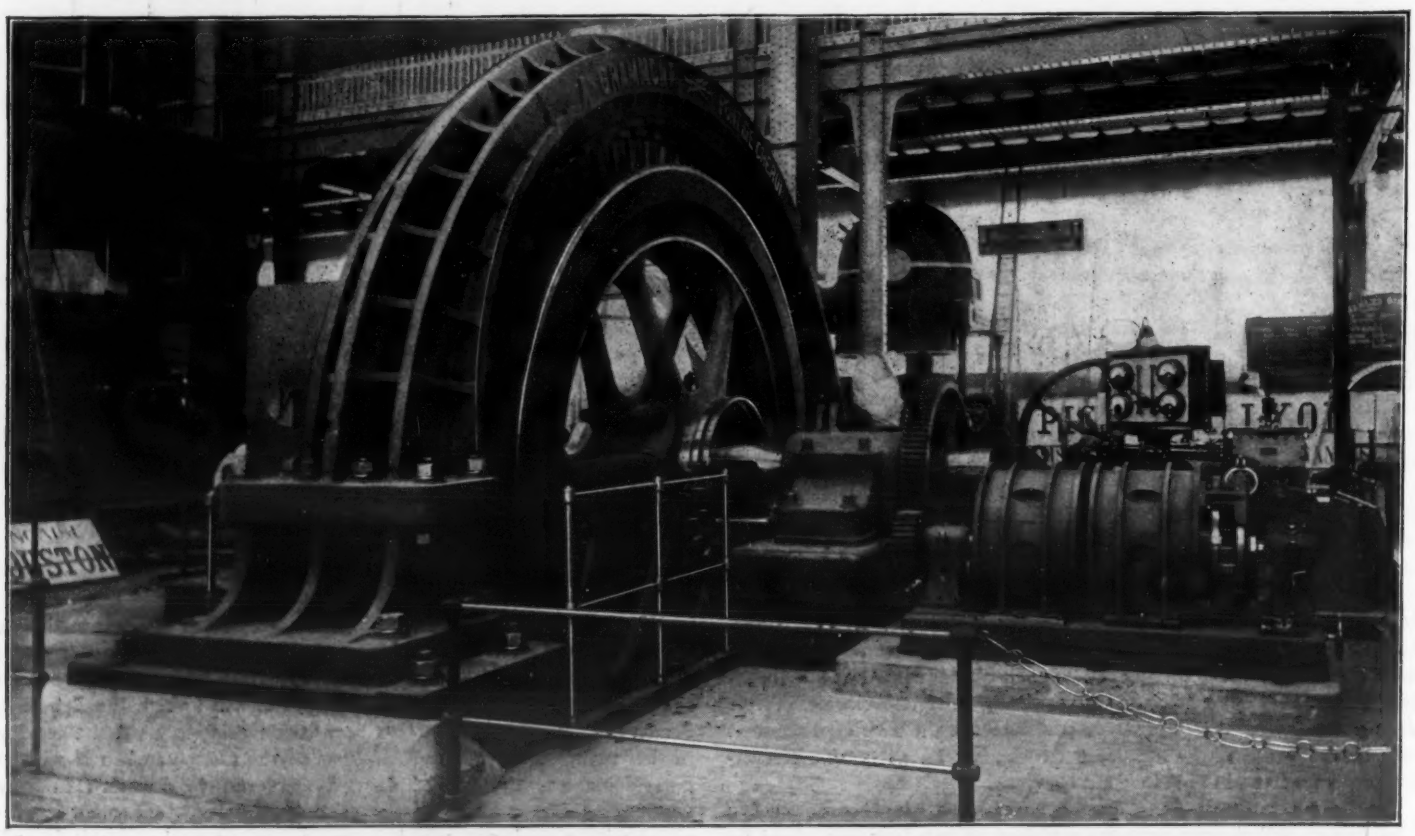


FIG. 1.—GRAMMONT EXHIBIT, SHOWING HUTIN & LEBLANC COMPOUND EXCITER.

equation stating that the frequency of the alternating current supplied to the stators must be equal to the speed of the armature, multiplied with the sum of the pole lines of the rotary field and the number of brush lines; as this sum has a certain fixed value for a given machine, the speed of the exciter must be always proportional to the speed of the alternator; the exciter and alternator must therefore be connected by a suitable gearing. The manner in which the arrangement, briefly sketched above, acts, may be explained as follows: An ordinary two-pole, direct-current machine has the field and the brushes fixed in space and the armature rotates; but it would work in exactly the same way if the armature would rest and the field would rotate, and the brushes would rotate also with the same speed and in the same direction as the field. Let now the connections between the armature and commutator be reversed with respect to a diameter $x\ y$ fixed in the commutator, as indicated in the adjoining Fig. 3, where the ordinary connections between armature and commutator are dotted lines and the new reversed connections are full lines. If pq was the brush line at a given moment with the ordinary connections, and p_1q_1 its position a little later, then with reversed connections the brush line is $p'q'$, and, a little later, $p_1'q_1'$. Hence, while before it was necessary that the brushes rotated in the same direction and with the same speed as the revolving field, now the brushes must rotate with the same speed as the revolving field, but in opposite direction. For a machine with n pole lines, the same result is obtained by means of n diameters of symmetry. Further, take again the case of the ordinary connections between armature and commutator, with brushes revolving in the same direction and with the same speed as the field, then the speed of revolution of the brushes can be varied by varying the number of the commutator segments which are in parallel; with k brush lines and n pole lines the speed of the brushes must be equal to that of the field, multiplied with the ratio n/k. It appears that by means of these considerations it is easy to solve the following problem: Given a direct-current armature with a certain number of brush lines, under the influence of one stator with a certain number of poles and supplied with alternating current of a given frequency; the armature revolves with a given speed in the same direction as the rotary field; under which condition can direct current be taken off by means of brushes fixed in space? The mathematics used to solve this problem are very simple and the answer reached was given above; namely, the speed of the exciter armature must be proportional to the frequency of the alternating current supplied to the stator, and the ratio of this speed and this frequency is determined

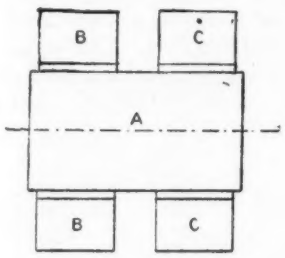


FIG. 2.

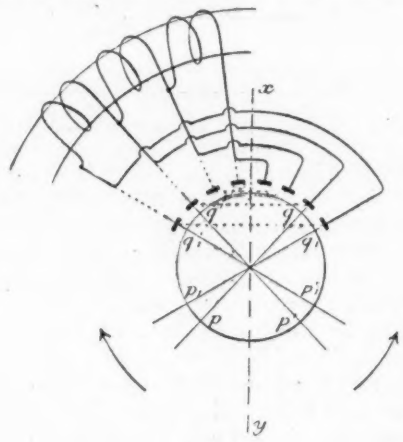


FIG. 3.

by the design of the exciter. Now, the possibility of compounding is at once apparent, when two different stators are used, as in the first figure, one in shunt across the terminals of the alternator, the other in series with the armature of the alternator. It remains to show how it is possible to obtain a compounding which holds good for any load and any power factor, by properly designing the two stators. The problem is to produce in the exciter a resulting field which has in each moment the following two characteristic properties: First, an intensity proportional to the required magnetizing current, and therefore varying with the load and the power factor; second, a direction independent of the load and power factor. The exciter thus becomes self-regulating in every respect. To simplify the explanation, how accurate compounding is accomplished, the alternator may be supposed to have two poles; also, the exciter two poles; the exciter may also be supposed to have a fixed armature and the brushes revolving. Then in the adjoining Fig. 4, the vector OJ may represent the magnetic field, due to the field magnets, of the alternator; the vector OI the magnetic field due to armature reaction; by combining OJ and OI the resultant magnetic flux OR is obtained. The voltage at the terminals depends upon OR. In the stator in shunt there is a flux $O'R'$ proportional to OR, and in the stator in series there is a flux $O'I'$ proportional to OI. In designing the exciter, it is always easy to arrange that $O'R'$ is to OR as $O'I'$ to OI. The two stators may be arranged so that the sum of the angles $R'O'I'$ and ROI is 180 degs. If then the axle of the alternator and the axle of the exciter

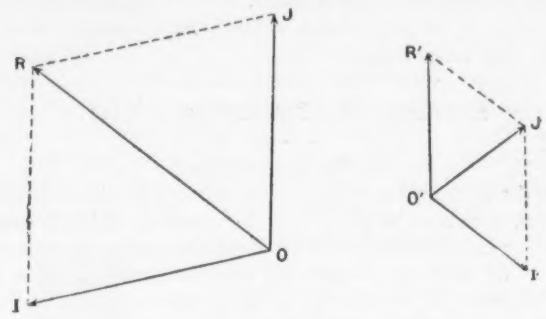


FIG. 4.

are placed end to end, and the two directions OR and OR' are brought to coincidence, OJ' will fall into the direction of OJ. Further, if OR or OI should advance or draw back, OR' *or* OI' would immediately conform to these displacements. There is not only proportionality, but also synchronism between OJ and OJ'. It follows that the brush line rests fixed in space whatever may be the load and power factor.

Abstracts of A. A. A. S. Papers.

Through the courtesy of the authors, etc., we are able to present herewith a few more abstracts of papers presented at the recent A. A. A. S. meeting, in the physics section.

The paper "On the Energy of the Cathode Rays," by W. G. Cady, gives an account of investigations at the Physical Institute of the University of Berlin, in order to determine the relation between the energy and other discharge phenomena of these rays. For this investigation the thermo-element, as used by J. J. Thomson and O. Berg, was employed, as much more exact than the calorimeter. Observations were also made with bolometers. The bolometer formed one arm of a Wheatstone bridge. The paper is in reality an experimental test of the emission hypothesis which Prof. Merritt supported in his vice-presidential address. By that hypothesis, a relation exists between the energy of the cathode rays, potential of discharge and amount of electricity transported by the rays, which is expressed by several equations, of which the crucial one is:

$$\frac{i\,V}{Q} = \frac{1 - r}{1 - r\,r'}$$

Where i is the intensity of the cathode current, V the potential of the cathode giving off a bundle of rays, Q the amount of heat given up to the conductor (ergs, per second) r is the fraction of the rays reflected, and the ratio r' : 1 expresses the ratio in which rays lose their energy on reflection.

The conclusion reached by comparing the limiting value of the ratio experimentally determined with this equation is in contradiction with results obtained by Merritt, thus:

If $r' = 1$ (Merritt) we still have $iV/Q = 1$. If in the limiting case, $r' = 0$, then $iV/Q = 1 - r$.

But Starke has found that platinum (the reflecting surface of Cady's bolometer), reflects about 40 per cent of the rays. Assuming therefore, that for the bolometer, $r = 0.4$, we find that when $iV/Q = 0.83$, $r' = 0.7$.

The importance of this investigation on the vexed question of the nature of cathode rays is evident, since the result, if established, is incompatible with the emission or corpuscular theory.

Prof. Cady criticizes Merritt's investigations thus: "Merritt compared the deflectibility of direct and reflected rays by observing the phosphorescence on the walls of the tube. It can hardly be supposed that the spot from the reflected ray can have been even approximately as distinct as that from the direct. Moreover, since an induction coil was used as a source of discharge, one would expect the formation of a 'magnetic spectrum,' which would greatly complicate the appear-

ance of both spots. Thus it is easy to see that a systematic error may have crept into the results. Whether such an error can have been great enough to give the value $r' = 1$, instead of $r' = 0.7$, is, of course, not certain; but it may be added that the energy of the cathode rays is proportional to the square of their deflectibility.

The paper of Prof. Geo. W. Patterson, Jr., on "Alternating Current Curves with the Wehnelt Interrupter," was a report of work done under the direction of the Department of Physics of the University of Michigan by Messrs. B. F. Bailey and L. F. Miller as candidates for the degree of M. A.—Mr. Bailey's account of this work was published in the ELECTRICAL WORLD AND ENGINEER for July 14, p. 52, and Aug. 11, p. 207.

Elements of Illumination.—VIII.

BY DR. LOUIS BELL.

AS to the distribution of the lights required for interior illumination, one must be guided by the intensity which is necessary. The examples already given show the general character of the problem. The laws upon which the solution depend may be formulated as follows: If we write L for the required or existing intensity of illumination in candle-feet at any point, C for the candle-power of the radiant and d for the distance in feet from that radiant, then:

$$L = \frac{C}{d^2} \qquad C = L\,d^2 \qquad d = \sqrt{\frac{C}{L}}$$

If the point in question receives light from more than one radiant, the illuminative effects must be summed, and if the radiants are equal,

$$L = n\ C\left(\frac{1}{d^2} + \frac{1}{d_1^2} \cdots \frac{1}{d_n^2}\right)\left(\frac{1}{1-k}\right)$$

$$C = \frac{L}{n\left(\frac{1}{d^2} + \frac{1}{d_1^2} + \cdots \frac{1}{d_n^2}\right)\left(\frac{1}{1-k}\right)}$$

L is of course in candle-feet and C in candle-power. In these expressions no account is taken of the varying angles of incidence of the light received from the several radiants. In principle, $L = \frac{C \cos i}{d^2}$ where i is the angle of incidence, in other words, the illumination decreases as it becomes oblique. In certain cases account must be taken of this fact, but since, as a rule, objects to be lighted are oblique to the plane of illumination, since cos i is small only in case of rather distant lights, of which the entire effect is small, and since the diffused light cannot be reckoned with, having no determinate direction, the question of obliquity, particularly when the radiants are numerous and well distributed, has seldom to be dealt with. It is rendered the more uncertain by the notorious inequality of the distribution of the light from ordinary illuminants, and it must be remembered that the whole aspect of the matter is changed by the use of reflectors.

In ordinary interior illumination one constantly meets limitations imposed by structural or artistic considerations. For example, in the last article we saw that the arrangement shown in Fig. 3. was highly desirable for economic reasons. But five lamps dangling by cords or rods, however ornamental, from the ceiling of a room 20 ft. square, while they might be tolerated in an office, would be quite inadmissible in a drawing-room. For domestic lighting one is practically confined to chandeliers, side lights or ceiling lights. The latter have been considerably used of late, sometimes with beautiful effects; sometimes unwisely.

To examine the effect of ceiling lights on the situation, refer to Fig 1, which shows the same room as Fig. 1 of the last paper. Assuming the same general conditions, let us find the illumination at a point p in the plane of illumination when given by a light r in the old position, and a ceiling light r', 6 ins. below the ceiling. The light being of 16 candle-power, the light at p is $L = \frac{16}{41} = .39$ candle foot when the lamp is at r, or $L = \frac{16}{74} = .21$ when the lamp is at r' close to the ceiling, neglecting diffused light. In a room very bright with white paint or paper, having, for example, $k = .60$ and $\left(\frac{1}{1-k}\right) = 2.50$ the total illumination would be $.39 + .97 = 1.36$, and since the diffusion does not materially change with the position of the light, the illumination in the second case would be, roughly, $21 + 97 = 1.18$; in other words, the change in position of the light would make but a small change in the intensity of the illumination.

There is evidently some error made in issuming that diffusion increases the illumination by a certain *ratio*, and Wybauw's hypothesis of replacing the diffused light by an imaginary radiant directly above the real radiant involves the same error. It is probably nearer the truth to assume, in case of an apartment having several radiants, that the total illumination at any point is that due to the lights severally, plus a uniform illumination, due to diffusion and proportional to k and C.

The practical upshot of the matter, however one may theorize on the rather hazy data, is that shifting the lights in a room from their usual height to the ceiling does not affect the illumination seriously if the walls and ceiling diffuse strongly, while if they are dark the change is decidedly unfavorable. This does not, however, imply that ceiling lights should not be used in dark-finished rooms, although it is very plain that if they are so used the lamps should be provided with reflectors, or themselves form reflectors, as in some lamps recently introduced. If the walls have a very low coefficient of diffusion it is obvious that all light falling upon them is nearly wasted, at least from the standpoint of illumination, and therefore the economic procedure is to deflect this light so that instead of falling upon the walls it shall be directed upon the plane of illumination, which is chosen to represent the average height from the floor at which are the things to be illuminated. If reflectors or their equivalents are skilfully applied, the radiants for the purpose in hand are nearly or quite doubled in intensity, so that there is a good opportunity for efficient lighting. But these reflecting media must be used with caution to avert the appearance of beams giving definite bright areas, and by far the best results may be obtained by using ground or frosted bulbs in such cases. So far as economy of light is concerned, reflectors can be advantageously used wherever the effective reflection exceeds the diffusion coefficient of the walls. By the effective reflection we mean the relation between the spherical aperture of the reflector and the spherical angle subtended by it, diminished by the absorption of the reflector. For example, with a hemispherical reflector having a coefficient of reflection of .70, the hemispherical intensity of the radient is 1.70 C, assuming a spherical distribution of the light. This value corresponds, so far as the plane of illumination is concerned, with a diffusion of $k = .40$, which signifies that, except in very light-finished rooms, the radiant is used more efficiently by employing a reflector than by trusting to the really very serviceable diffusion from the walls. But if the reflector aperture be as great as a hemisphere, there is still some material aid to be gained by diffusion. In the case already discussed in Fig. 3 of the last paper, if reflector lamps were used, five 16-cp lamps would meet the requirements and would fall but a trifle below the requirements even if used as ceiling lamps.

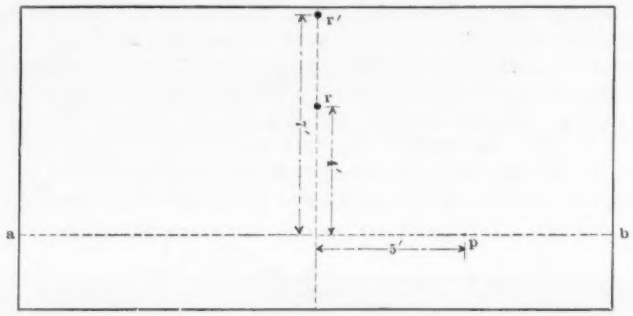


FIG. 1.—ELEVATION OF ROOM.

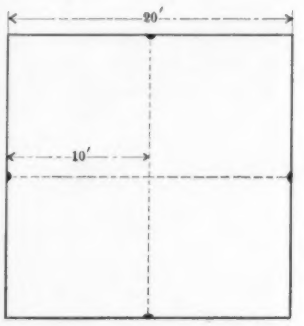
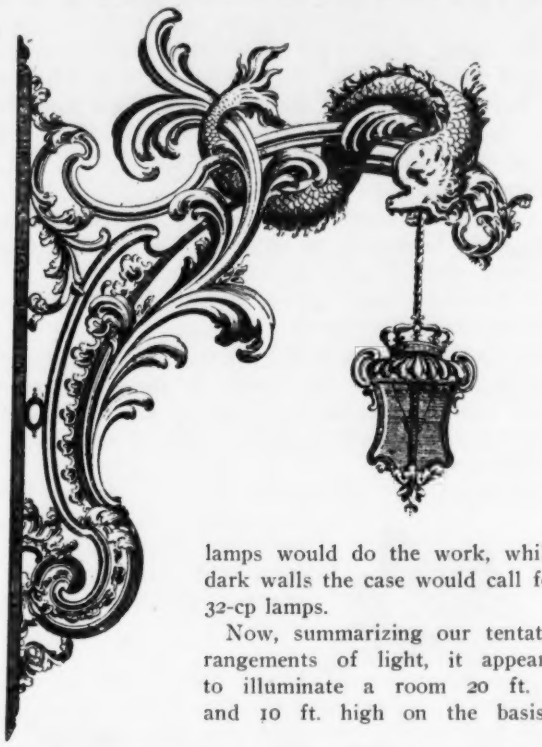


FIG. 2.—PLAN OF ROOM.

It is safe to say that by the use of reflector lamps the work of effective lighting from the ceiling is made fairly easy, if the ceilings are of ordinary height. Without reflectors it is a method greatly lacking in economy.

The use of side lights close to the wall, or on short brackets, is preferable to lighting from the ceiling when the latter is high, or when, as often happens, strong local illumination is needed. Reflector lamps may here again be used with very great effect if the walls are at all dark in tone. Fig. 2 gives in diagram the simplest arrangement of such lamps. We may assume their height as a trifle

less than in the case of the suspended lights, say, 3 ft. above the plane of illumination, and that they are equipped with reflectors giving a hemispherical distribution of light. In Fig. 2 the position of the lamps is indicated by black dots, as before. It is evident that the corners will be the points of minimum illumination, and that in the central part of the room the lighting will be rather weak, although, on the whole, the distribution of light will be good. With help from diffusion to the extent assumed in the last paper, four 20-cp reflector



lamps would do the work, while with dark walls the case would call for four 32-cp lamps.

Now, summarizing our tentative arrangements of light, it appears that to illuminate a room 20 ft. square and 10 ft. high on the basis of a

FIG. 3.—LANTERN FIXTURE (EIGHTEENTH CENTURY).

minimum of 1 candle-foot, will require from 80 to 144 effective candle-power, according to the arrangement of the lights, if the finish is light, and half as much again, at least, if the finish is dark. The floor space being 400 sq. ft., it appears that the illumination is on the basis of about 3 to 5 sq. ft. per effective candle-power. The former figure

FIG. 4.—WROUGHT-IRON DOUBLE FIXTURE (EIGHTEENTH CENTURY).

will give good illumination under all ordinary conditions, even taking the nominal candle-power of the radiants as their real candle-power; the latter demands a combination of light finish and very skilfully arranged lights. For very brilliant effects, no more than 2 sq. ft. per candle should be allowed, while if economy is an object, 1-cp to 4 sq. ft. will furnish a very good groundwork of illumination, to be strengthened locally by a drop light or reading lamp. The intensity thus deduced we may compare to advantage with the results obtained by various investigators, reducing them all to such terms as will apply to the assumed room which we have had under discussion.

Illumination required for rooms:

Just deduced.....	1-cp per 3 sq. ft.
Uppenborn	1-cp per 3.6 sq. ft.
Piazzoli	1-cp per 3.5 sq. ft.
Fontaine.....	1-cp per 7.0 sq. ft. (approximation).

In very high rooms the illumination just indicated must be materially increased, owing to the usual necessity for placing the lamps rather higher than in the case just given, and on account of the lessened aid received from diffuse reflection. The amount of this increase is rather uncertain, but in very high rooms it would be wise to allow certainly 1-cp for every 2 sq. ft., and sometimes, as in ballrooms, and other special cases requiring the most brilliant lighting, as much as 1-cp per square foot.

On the other hand, in most domestic lighting, the amount of lighting needed may be reduced by a little tact. Ordinary living rooms, such as parlors, libraries, and the

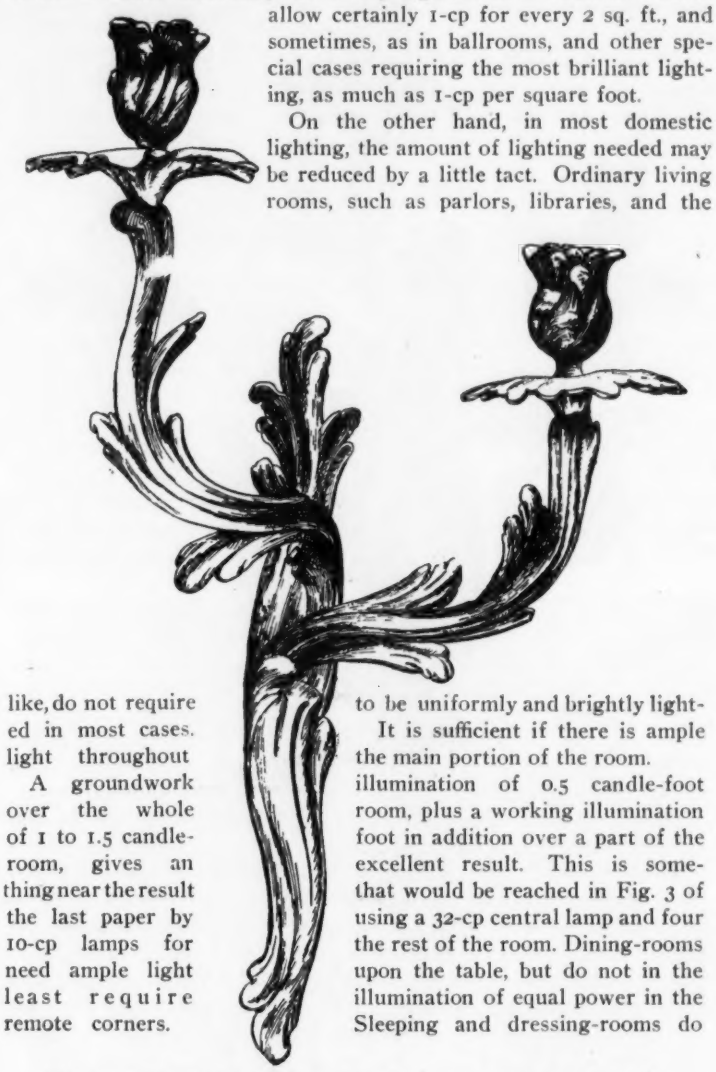


FIG. 5.—GILT BRONZE DOUBLE FIXTURE (EIGHTEENTH CENTURY).

like, do not require to be uniformly and brightly lighted in most cases.

It is sufficient if there is ample light throughout the main portion of the room.

A groundwork illumination of 0.5 candle-foot over the whole room, plus a working illumination of 1 to 1.5 candle-foot in addition over a part of the room, gives an excellent result. This is something near the result that would be reached in Fig. 3 of the last paper by using a 32-cp central lamp and four 10-cp lamps for the rest of the room. Dining-rooms need ample light upon the table, but do not require as much in the remote corners. In the illumination of equal power in the least important parts. Sleeping and dressing-rooms do not require strong light so much as well-placed light. A bed-room of the dimensions we have been discussing could be very effectively lighted with three or four 16-cp lamps, provided they were placed where they could do the most good.

To go into detail a little, perhaps the most important rule for domestic lighting is never to use, indoors, an incandescent or other brilliant light, *unshaded*. Ground or frosted bulbs are particularly good when incandescents are used, and opal shades, or holophane globes, which also reduce the intrinsic brilliancy, are available with almost any kind of radiant. Ornamental shades of tinted glass or of fabrics are exceedingly useful now and then, when arranged to harmonize with their surroundings.

In incandescent lighting the lamps may be placed in any position. With gas or other flame radiants, ceiling lights are not practicable. As to the intensity of the individual radiants, considerable latitude may be taken. In many instances, incandescents or gas or other lights of as low as 8 to 10-cp are convenient, while for stronger illumination

radiants of 15 to 20-cp reduce the cost of installation, and for special purposes lights of 30 to 50-cp, incandescents or incandescent gas lamps, are most useful. To get a clear view of the application of the principles here laid down it will be well to take up in some detail the illumination of a typical modern house in its various particulars.

Beginning at the porch, the light here is of purely utilitarian value. One 32-cp incandescent or its equivalent in gas would generally be sufficient, enclosed in an inoffensive antique iron or bronze lantern, of which a beautiful example from the hand of an eighteenth century master, is shown in Fig. 3.

Hall. Assumed dimensions, 15 ft. x 20 ft., finished in some combination like ebony and old yellow. Generally the staircase forbids effective use of a chandelier, and lights can best be put upon wrought-iron side brackets. Possibly Fig. 4, a wrought-iron fixture of the eighteenth century, may suggest the effect intended. The lighting required for the 300 sq. ft. is not strong, and four 16-cp or eight 8-cp units, arranged to two or four brackets, would give all the illumination ever required. Lanterns are often used here, but they are generally in the way.

Library. Assumed, 20 ft. x 20 ft., in mahogany and dull green. The form of the room and the presence of bookcases complicates the illumination. The bookcases, unless so much space is absolutely necessary, should not be carried to the ceiling. The conditions are severe. With incandescents very good results could be reached by, say, 12 8-cp, ground-bulb, reflector lamps, worked into the frieze, and a reading lamp of not less than 32-cp, a drop-light, preferably with as a tinted holophane globe. With gas or with high bookcases, old brass side-brackets on each

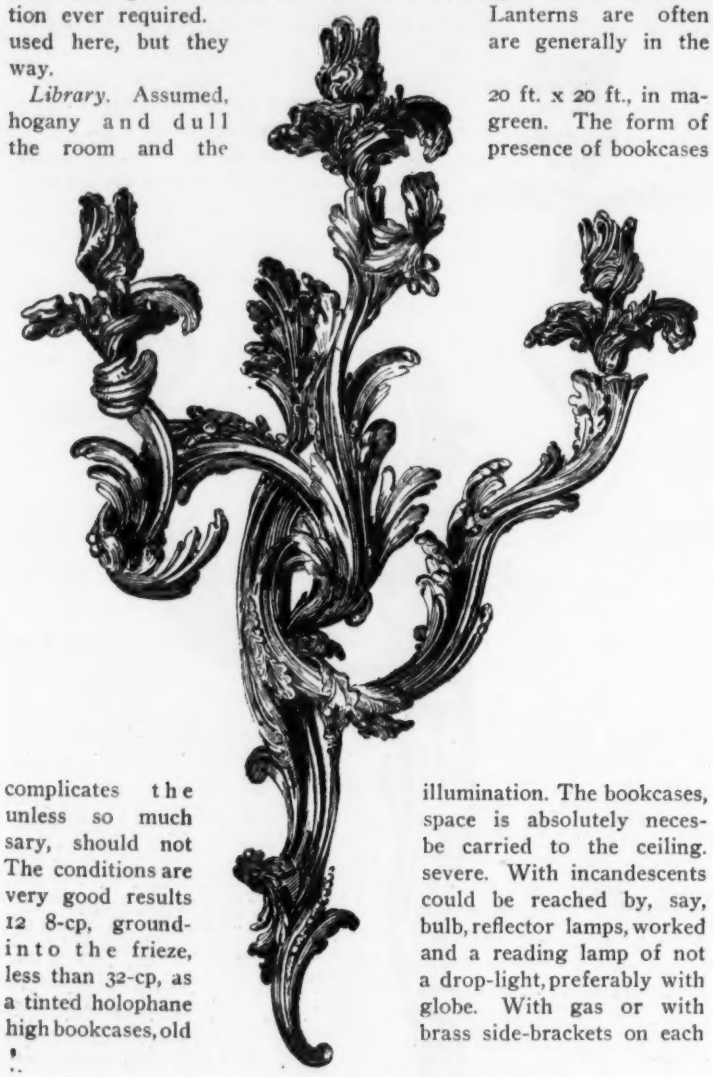


FIG. 6.—GILT BRONZE TRIPLE FIXTURE (EIGHTEENTH CENTURY).

side of the fireplace or elsewhere opposite the cases, carrying in all the equivalent of eight 16-cp lamps, and a mantle burner, well shaded, as a reading lamp, would answer. In fact, very good work could be gotten from two shaded mantle burners as side lights. Fig. 5, an antique gilt bronze fixture for two lights, is a fine example of the sort of thing which could well replace some of more recent manufacture.

Reception Room. Assumed, 15 ft. x 15 ft., cream and rose, or similar light finish. Strong light is not needed here, and an ornate gilt brass chandelier, carrying four 8-cp or 10cp lamps or their equivalent should prove ample.

Music Room. Assumed, 20 ft. x 25 ft., in white and gold or the like. For musical purposes two 32-cp lights in holophane globes, carried as piano lamps, shaded, and for general illumination about twelve 8-cp lights, carried in groups on elaborate gilt bronze brackets or sconces. Note Fig. 6 as a type of eighteenth century design for such purposes. The arrangement, of course, hinges on the position of windows, etc., and since such a room is often used as a ball-room, in case of electric lighting, provision should be made for replacing the 8-cp by 32-cp lamps. With gas, the fixtures should be planned so as to provide additional lamps.

Dining-Room. Assumed, 15 ft. x 20 ft., in dark antique oak or mahogany and tapestries or other dark wall finish. Here ceiling or frieze lamps are in place, one or the other, according to the nature of the finish. Eight 8-cp reflector lamps, ground, worked into the decoration, would give a good groundwork, backed up by, say, six more 8-cp or 10-cp, ground-bulb lamps, on wrought-iron brackets flanking the mantel, or, for a yet better artistic effect, by shaded candelabra upon the table itself. Fig. 7 shows a beautiful bracket in wrought iron admirably fitted for carrying a single powerful light. Using gas, one would almost be driven to an elaboration of the side brackets, or to a chandelier, too often an abomination, and always difficult to make artistic for such a place.

Billiard Room. Assumed, 15 ft. x 20 ft. Dull reds and greens in finish. Lighting here must be utilitarian. It requires four 32-cp lamps bearing directly upon the table. Incandescents or mantle burners in shaded holophane globes, or with slightly translucent reflectors, answer the purpose well.

Six Bed-rooms. Assumed, 15 ft. by 15 ft., finished in cream or other light paint and with rather light walls. In the smaller rooms, two 16-cp lights bearing upon the dressing-table are ample, and in the larger rooms a third bracket, carrying another 16-cp lamp, is all that would be required.

Two Dressing-rooms. Assumed, 10 ft. x 15 ft., in light finish, like the chambers. Two 16-cp lamps, bearing on the dressing-table, will do the work well. Brackets here and in chambers should generally be of gilt brass.

FIG. 7.—SINGLE FIXTURE IN WROUGHT IRON (EIGHTEENTH CENTURY).

Two Bath-rooms. Assumed, 8 ft. x 10 ft., in white and Delft blue or other light finish. One 16-cp light, carried on bracket, is sufficient.

Two Servants' Rooms. Assumed, 10 ft. x 15 ft. Light finish. One 16-cp lamp, bracketed, near dressing-table.

Kitchen. Assumed, 15 ft. x 15 ft. Light wood and paint. Two 16-cp lamps.

Pantry. Assumed, 10 ft. x 15 ft. One 16-cp.

Back hall and cellar would be lighted with 8-cp lamps, in all to the number of about six. Upstairs halls, three 16-cp.

This programme is merely intended as a hint about the requirements, and while it is laid out for a fairly large house, containing nineteen rooms and two baths, its details will furnish suggestions applicable to many places. In closing, it is worth mentioning that where incandescents are available, an 8-cp lamp of the reflector variety, should be placed in the ceiling of every large closet, and concontrolled by a switch from the room or by an automatic switch, turning it on when the door is fully opened.

The lighting just described may be summarized as follows (see table on next page):

The noticeable thing about this table is the large number of 8-cp.

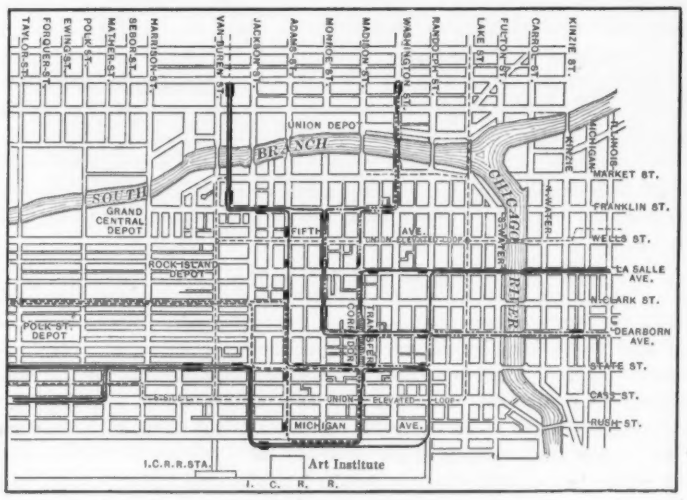
lamps. These are for the purpose of giving good distribution of light in the rooms when it is most necessary. The total is equivalent to 74 16-cp lamps, by no means a large installation for a house of this size. In using gas, mantle burners should be used where 32-cp lamps are indicated. These should always be given pinkish or yellowish shades, to kill the usual greenish tinge of the light. Pink glass shades, or, better, holophane globes are useful, or very diaphanous ornamental fabric shades, lightly dyed with erythrosine, aurine, or saffronine. The former is rather fugitive, although perhaps the best in tint. In a room with red walls of almost any shade, the diffused light corrects the greenish tint of the radiants, but these are too bright to go without shading in any event. Mantle burners greatly economize the use of gas, and when properly shaded may be advantageously used almost anywhere, since they use just about the same amount of gas as ordinary burners and give about three times as much light. They are too powerful to give the best artistic results, however, unless very

Room.	8-cp.	16-cp.	32-cp.	Sq. ft. per. cp	Remarks.
Hall	8			4.7	
Library	12		1	3.1	8-cp reflector lamps.
Reception room	4			7.0	
Music room	12		2	3.0	
Dining room	14			2.7—	Eight reflector lamps.
Billiard room			4	2.3	32-cp with reflectors.
Porch			1		
Bedrooms (6)		14		7.0	
Dressing rooms (2)		4		4.7	
Servants' rooms (2)		2		9.4	
Bathrooms (2)		2		5.0	
Kitchen, Pantry		3			
Halls, Cellar	6	3			
Closets (4)	4				Reflector lamps.
Total	60	28	8		

cautiously used. In applying them to a case such as that we have just been considering, they should be considered as equivalent to two 16-cp incandescents, for, while really somewhat brighter than this suggestion would indicate, a single radiant is less effective than two of half the power. Throughout this estimate the radiants are taken at their rated candle-powers, and while they seldom reach them, sufficient allowance for this fact has been made.

Subway for Chicago.

The accompanying map shows the routes of proposed subway loops in Chicago, to relieve the congestion of surface traffic in the business section of the city. The plan was presented to the street railway commission by President J. M. Roach, of the Chicago Union Traction Company, and in developing the system the experience in similar undertakings in various European cities and in New York was considered. The estimated cost of this improvement is $25,000,000. All of the loops will touch at a station to be located under Madison Street, between Dearborn and State Streets, at which point transfers will be issued. The proposed tunnel will be 32 ft. below the street level. All gas mains, sewers, electric conduits, pneumatic tubes, etc., will be located above instead of below the tunnel. The tunnel will be 32 ft. wide and 14 ft. high, and will be divided into two longitudinal compartments by a wall of masonry.



MAP OF PROPOSED SUBWAY.

Hot Weather at the Paris Exposition.

Paris has been experiencing a spell of such tropical weather as is seldom known in this part of France, and following closely upon an exceptionally cold spring and early summer, it has perhaps been responsible for the general falling off in attendance which has characterized the last few days at the Exposition. The months of August and September will, however, doubtless bring large crowds of visitors, and already many parties of school children may be seen filing along the aisles and galleries, as well as groups of more mature age and members of engineering societies. Military bands in the Champ de Mars kiosques prove to be very popular, and the special fêtes on Friday evenings, when all the buildings are illuminated on their façades and the trees are hung with colored lanterns, are drawing many people to the Exposition grounds, where the cool of the evening becomes very enjoyable after the heat of the day.

The visit of the Shah of Persia to Paris is the feature of greatest interest at the present moment. Almost the first occupation of His Majestry was a walk through the Exposition, taking a little of it at a time. On Aug. 31 he visited the Salle des Fêtes and came out through the passage leading to the American Salon d'Honneur or Court of Honor, which he traversed, inspecting its treasures.

Schieren Belts at the Paris Exposition.

On the main floor of the Palace of Machinery and Electricity, in the United States section, a very fine display of belting is made by Chas. A. Schieren & Co., of New York City. In a space of 300 sq. ft. occupied by them are samples of their manufacture to the value of $9,000, including belts 72 ins., 60 ins. and 48 ins. wide, all three-ply and 150 ft. long. The 72-in. belt is, in fact, the largest in the Exposition, as, although another manufacturer shows a belt of this width, it is only a few feet long, and wound upon a wooden drum. Chas. A. Schieren & Co.'s belts are all shown in solid rolls, and many different varieties are exhibited, such as their well-known perforated belting for dynamos, and the American patent joint leather link belting for

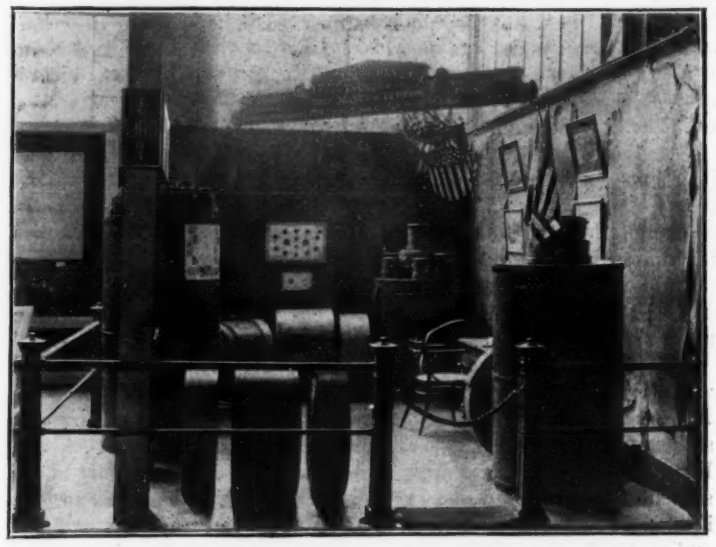


EXHIBIT OF LEATHER AND BELTING.

use on crowned pulleys, a flexible centre allowing the belt to lie close to the pulley face. Samples of lace-sewed belts are also shown, these being much used in Cuba and South American countries. The walls of the exhibit space are hung with large tanned hides such as are used in the manufacture of belts, and framed photographs give an idea of the different establishments of the company. The hides are prepared in their own tannery at Bristol, Tenn., which has a capacity of 120,000 hides per year. The tanning is done with oak bark only, requiring a period of eight or nine months for each hide; instead of by the method pursued in Europe of using chemicals as well, which shortens the time of treatment to perhaps two months, but produces a far less satisfactory belt in which the fibres are short and much less strength and durability are obtained. Chas. A. Schieren & Co. is the only

American firm exhibiting belting in the Exposition. They have agencies and do an extensive business in England, Russia, Denmark, Norway and Sweden, and other European countries.

PARIS EXPOSITION NOTES.

Jones & Lamson Machine Company have in the Palace of Machinery and Electricity one of their flat turret lathes, recommended for precision of work, rapidity of action and simplicity of operation. These machines are shown at work in the Exposition Annex at Vincennes.

The Bristol Company, of Waterbury, Conn., have a set of their recording instruments on view, including ammeter, voltmeter, pyrometer for heat indications, and pressure gauge for boilers. The value of a continuous record of station performance is apparent to all engineers, and the adoption of instruments of this type is becoming very general.

The Fellows Gear Shaper Company, of Springfield, Vt., show one of their machines alongside the Jones & Lamson lathe. This shaper makes use of a traveling toothed cutter, revolving slowly while it cuts the teeth on the blank. By this method it is said that all unevenness of tooth form is avoided, and more perfect gears are obtained that is possible by any other method.

E. B. Meyrowitz, of New York, has in his exhibit in the gallery of Electricity Building a large balanced electromagnet for use in removing from the eyes particles of steel or iron. The construction is very solid, the instrument weighing, with its stand, 600 lbs.; but it is capable of easy and delicate manipulation. This exhibitor has also on view the Vetter current tap, a well-known device for obtaining from a one-lamp bracket the use of two lamps and a fan motor at the same time.

The Lunkenheimer Company occupy a prominent space opposite Director Drake's office, in Electricity Building, where they show samples of their varied products. Their newest specialty is a line of injectors, and they have been so busy in that particular department in filling home orders that up to the present they have been unable to supply injectors for the European market. A full assortment is now, however, on the way to their London branch office, and it is expected that a big trade will be done in this line.

The Simonds Manufacturing Company have a large collection of saws and veneer knives in the exhibit in Electricity Building at Champ de Mars, and are represented also in the Machinery Hall at Vincennes. They have the only double-edged band saw in Europe, and at Vincennes the largest veneer knife the world has ever seen, 178 ins. in length, 10 ins. wide, ¾-in. thick. The company's main office is at Fitchburg, Mass., and branch houses are at Chicago, New Orleans, San Francisco, Portland, Ore., and Seattle, Wash.

The Edison Phonograph exhibit has always a large crowd around it to listen to the reproductions of songs by famous singers or concert pieces and martial music by well-known bands. Mr. L. E. Kayser, in charge of the exhibit for Mr. C. E. Stevens, has just consummated a large deal with Ossef Bey, of Constantinople, to furnish him with concert machines, records and blanks. Mr. Kayser states that the Edison "Home Phonograph" is very much appreciated by the Germans, among whom there is a large call for these instruments.

The Wagner Electric Mfg. Company shows a marble switchboard with several of its well-known types of instruments. These are made for either the front or back of the board, and constitute handsome station instruments, giving absolutely dead-beat indications. A type F wattmeter is here exhibited, being placed on the upper part of the switchboard, the connections to be made in front. Below this are two illuminated-dial, back-of-the-board type ammeters with narrow front, and under them a wide front type H voltmeter with illuminated dial. This company also has a 3-hp single-phase self-starting motor, to run at 1500 r. p. m.

The Gutta Percha Supply.

The scarcity of the supply of gutta percha, so necessary in cable manufacture, is receiving extraordinary attention from the Germans. They are urging increased efforts for its production in South America and in the East Indies. An article was recently published in a German colonial magazine containing a table of the prospective cable lines showing a total of 61,137 miles, of which England has 19,251, France 18,630, Germany 14,900 and the United States 9315 kilometres. It is estimated that each kilometre of cable requires 80 kilogrammes of gutta percha. At an average price of $2.16 a kilogramme, this would require an outlay of $17,347,000.

An Investigation of the Zeeman Effect.*

By Prof. Herbert M. Reese.

In this investigation the simplest and most direct method possible was used. The source of light, an electric spark in air, was placed between the poles of a strong electromagnet, and the light was focused on the slit of a concave grating, 15,000 lines to the inch, 13 ft. radius. The spectra were photographed on plates 11½ ins. long, taking in 400 Ougström units in the second spectrum. When it was desired to study the polarization of the lines, a Nicol's prism was interposed between the spark and the focusing lens.

The strongest field attainable was 28,500 C. G. S. units.

To determine whether the separation was strictly proportional to the strength of the field, a number of photographs were taken of the same lines with fields ranging from 6000 to 27,000 C. G. S. units. One such series was taken with the group of three cadmium lines standing at the head of the second subordinate series, and the corresponding zinc lines. For this purpose one of the spark-terminals was a rod of cadmium, the other of zinc. A similar series was taken with the corresponding lines of magnesium alone. These lines were selected as offering unusually wide separation and a considerable variety of complexity. As Preston has already shown,† the least refrangible of the three lines in each group is a sharp triplet, the most refrangible a diffuse triplet, and the middle line a sextuplet. I may note in passing that my plates confirm Preston's statements in regard to these lines in all their essential points.

After the plates had been carefully measured a curve was plotted for each line, having field-strengths as abscissae and the corresponding separations as ordinates. For the "sharp triplets" the curves are almost perfectly straight. For the sextuplets, however, although straight in the lower portion, they show a decided tendency to droop, as if the separation increases less rapidly with the field when the latter becomes very intense; and for the "diffuse triplets" this tendency is much more marked. It appears, then, that the magnetic separation is not always proportional to the strength of the field, except for rather weak fields.

All these lines are strongly shaded toward the red, both in their natural condition and when they are split up into triplets or sextuplets. As the field becomes stronger, however, the shading considerably diminishes and the line becomes more definite. I have noticed the same effect on other heavily shaded lines.

The most complicated line which I have observed is the magnesium line at 3832.45. In a very strong field it seems to have five components, a very strong central one, flanked by two progressively fainter on each side. The strong central component and the very faint extremes are polarized in a plane through the axis of the magnet, the other two in a plane normal thereto.

A number of other lines were examined in the spectra of magnesium, cadmium, zinc, iron, nickel, titanium, carbon and mercury. Most of them are triplets, with separations varying in most cases from about half an Ougström unit down to an amount too small to resolve, for a field of about 25,000 units. Some appear not to be acted upon at all, and some are quadruplets instead of triplets. In the iron spectrum the most interesting lines are 3587.13, 3733.47 and 3865.67, which show what has been called "reversed polarization"—that is, the central component of the triplet is polarized in a plane *through* the axis of the magnet instead of *at right angles,* and the lateral components vice versa. This phenomenon was first observed by Becquerel and Deslandres.[1]

Considerable difficulty is experienced in handling iron spark-terminals in a strong field, and their presence not only weakens the field where the spark occurs, but makes it unmeasurable. These difficulties may be avoided by the use of small commercial carbon rods instead of iron. The carbon contains enough iron and other substances as impurities to show their spectra very well without affecting the field to any extent. The strongest field that could be used showed no effect on the carbon band at 3883.

A paper has recently been published by Zeeman,[2] giving instances of asymmetry in weak fields, as regards both intensity and spacing. The subject is especially interesting from the recent theoretical papers of Voigt.[3] I have not been able to verify all the cases noted by Zeeman; for instance, I have observed no lines in which the violet com-

*Abstract of paper read to the American Physical Association and the A. A. A. S. at the New York meeting.
†Nature, Vol. 59, pp. 248, 367.
[1]Comptes Rendus, April 4, 1898, p. 997.
[2]Proc. Roy. Amst. Acad. Sci., Dec. 30, 1899.
[3]Wied. Annal., Vol. 69, p. 290.

ponent is the stronger; but many of the cases he cites and some others appear on my plates, and in every case the asymmetry seems to disappear when the field increases, as Voigt's theory indicates.

Lindstrom Automobile Motors.

In articles which appeared recently in these pages on the Hewitt-Lindstrom electric automobiles, reference was made to the work of Mr. C. A. Lindstrom in improving motors used for such service, wherein usually current of low voltage is used. Among the earlier patents of Mr. Lindstrom on this subject was one in which he described his method of casting pole pieces integral with the field ring, omitting pole shoes, so that eddy currents are avoided and a machine obtained of higher efficiency for its size and bulk. Mr. Lindstrom

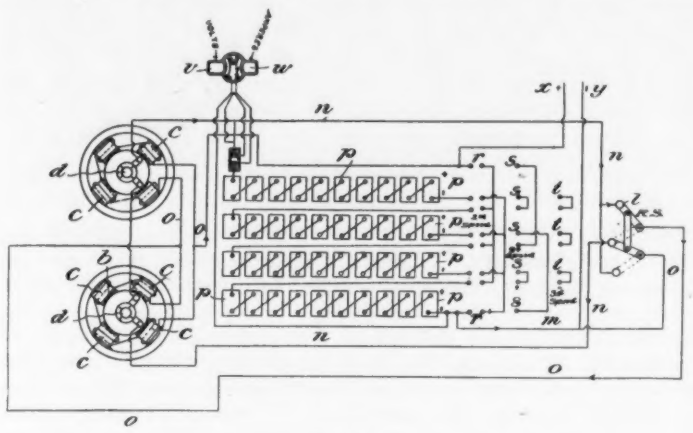


FIG. 1.

has further observed that the rules as to air-gap do not apply to such motors of low voltage, say around 80 volts, and that the wide air-gap can be narrowed. He has now taken out a further patent, assigned to the Hewitt-Lindstrom Motor Company, of Chicago, in which his more recent practice is described. In this invention the armatures of the two motors on the rear axle, working independently on the two wheels, are always in series and the fields always in multiple, and the windings are calculated on 80 volts in the field and 40 volts in each armature. He thus uses the least possible amount of current at all times. Fig. 1 illustrates the electrical connection between the motors, battery and switch. Fig. 2 is an enlarged longitudinal section through one of the motors. Fig. 3 is an end view of one of the motors with the end of casing removed and the commutator removed. Fig. 4 is a

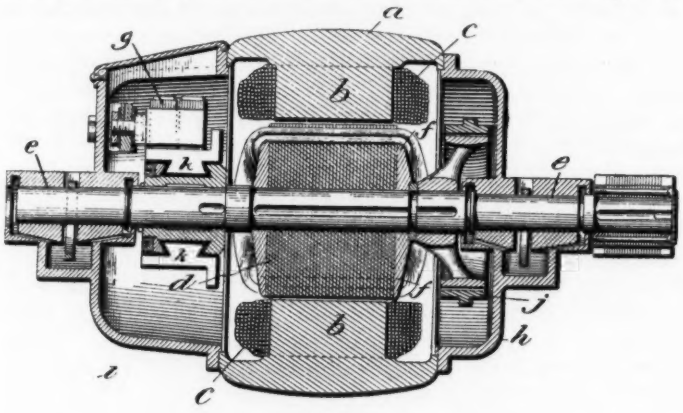


FIG. 2.

detail view illustrating the air-gap. In Fig. 2, *a* is the field ring of the motor, which is cast with four inwardly-projecting equidistant pole pieces *b*, around which can be slipped coils *c*, of wire, these poles and coils forming the field magnets of the motor, and the coils *c* in each motor being connected in series, as indicated in the drawings. The core *d* of the armature is made up of laminated sections secured upon the armature shaft by means of the end plates *f*, as shown. This armature, as shown, has 33 coils divided into two halves. It will be observed that the armature is of such diameter that its periphery almost touches the field magnets, and it is a principle advocated by Mr. Lindstrom and here introduced to make the "air-gap," as the space between the periphery of the armature and the inner end of the pole pieces *b* or field magnets is termed, as small as possible.

While it has been a rule that the air-gaps shall not be less than one-fourth the width of the armature slot—i. e., the slots or grooves in the armature core wherein the wires are placed—Mr. Lindstrom, on the contrary, makes the air-gap as thin as possible. For example, where his armature slot or channel is not more than twenty sixty-fourths of an inch in width he has an air-gap less than three sixty-fourths of an inch in thickness.

The field ring *a* can be conveniently used as part of the motor casing, and, as shown, it has attached to its opposite ends the hood castings *h* and *i*, in which are formed the journal bearings *e* for the armature shaft. The hood *h* incloses and protects the brake mechanism *j* of the motor (which is not claimed herein) and the hood *i* incloses the commutator *k*, which is of ordinary construction and need not be particularly described herein, but preferably the commutator bars are made unusually thick in order to avoid heating of the brushes *g* and consequent sparking.

In Fig. 1 are shown two motors which may be applied to the running gear of a vehicle, so that the opposite drive wheels thereon can be directly driven from the motor shaft by means of gearing, as usual. The manner of wiring the motors is illustrated clearly in the diagram, Fig. 1, wherein it will be seen that the field coils *c* of each motor are in series as usual, but the fields of the two motors are connected to the battery in multiple, while the armatures *d* of the two motors are connected in series. This connection is unvarying, no matter how the electromotive force may be changed, and the voltage passing through the armatures will always be of exactly one-half that passing through the fields.

When applied to vehicles, Mr. Lindstrom employs, as noted in previous articles, a storage battery as the source of power, carried in the body of the vehicle, and the connections are shown in Fig. 1. A reversing switch *l* of ordinary construction is employed, located at a suitable point in the usual manner, and this switch is usually con-

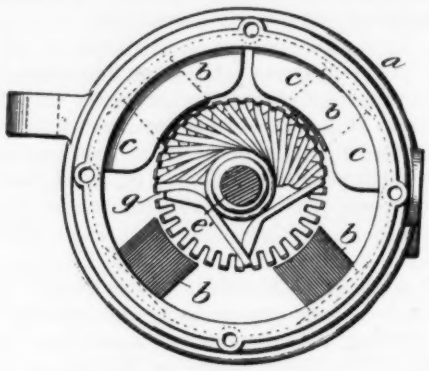


FIG. 3.

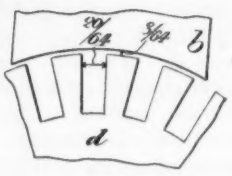


FIG. 4.

nected by a wire *m* to one terminal of the battery and by a wire *n* to the armatures of the motors, so that the current will be sent always through the armatures of the motors in series, this wire *n* leading back to the other pole of the switch *l*, so that the current will pass through the switch to another wire *o*, which is connected to the fields of the motors in multiple, and the wire *o* leads back to the other terminal of the battery. Thus the current flows always through the motor armatures in series and through the motor fields in multiple. Of course, by shifting the reversing switch *l* the direction in which the current will flow through the fields and armatures will be reversed.

Pennsylvania Electrical Contractors.

The Association of Electrical Contractors of Pittsburg and Western Pennsylvania, who organized in May, 1899, were granted a charter of incorporation from the courts of Allegheny County, on July 21, 1900. They held their election of officers for one year at the new headquarters, Room 300, Lewis Building, Pittsburg, Pa., Friday, Aug. 3, 1900, and the following officers were elected: President, Geo. R. Mathieu; vice-president, James Brown; secretary, F. F. Howe; treasurer, I. Patterson. The following constitute the Board of Directors of the association: George R. Mathieu, F. F. Howe, I. Patterson, E. D. Smith, H. W. Clelland, R. A. M. Steel, J. N. G. Fullman, J. W. Hays and A. E. Eldridge. The objects of the association are the encouragement and protection of trade and commerce, by abating trade abuses, by exposing and preventing fraud in electrical work and material, to establish and maintain a place of meeting for the purpose of improving and increasing the knowledge and skill of its members, and the dissemination of useful information among its members.

CURRENT NEWS AND NOTES.

PARIS-BERLIN.—The long-distance telephone line between Paris and Berlin has been put into successful operation.

THE CANADIAN ELECTRICAL ASSOCIATION.—The next meeting of the Canadian Electrical Association will be held in Kingston, Ont., on Aug. 29, 30 and 31.

FARMERS' TELEPHONES.—Mr. S. P. Sherin, of the New Telephone Company, stated before the tax board at Indianapolis that 8000 Indiana farmers had telephones in their houses.

NEW SOUTH WALES.—Mr. G. W. Bell, U. S. Consul at Sydney, N. S. W., calls attention to a variety of opportunities in the market there and remarks that among the ten classes of articles in which Germany has increased her market in New South Wales most rapidly during the past five years, one has been telegraphic material.

CHINESE CABLE.—The Commercial Cable Company announces that it is advised that the Great Northern Telegraph Company is laying a reliable cable from Taku to Chefoo, and that the Eastern Company will lay a cable between Chefoo and Shanghai. Rates will be the same as those of the Chinese land lines. The opening of these lines will be advised by telegraph.

NEW YORK STREET RAILWAY ASSOCIATION.—The Street Railway Association of the State of New York will hold its next annual meeting at Buffalo on Sept. 18 and 19, instead of Sept. 11 and 12, as previously announced. The change of date was rendered necessary on account of the inability to secure proper hotel accommodations for the time originally set.

WIRELESS TELEPHONY.—A system of transmission without wires, by means of which telephony as well as telegraphy may be accomplished, is reported from Philadelphia. The inventor, A. Frederick Collins, claims that a perfect method of selection has been obtained by the use of electrical resonance. Although no details have as yet been made public, it appears that the earth is to be used as a return circuit.

THERMOELECTRIC GENERATOR.—Mr. Jesse Oliver, an electrical engineer, of Memphis, Tenn., has invented and patented a thermoelectric generator, which is to be marketed by a company now being organized in Memphis. Mr. Oliver claims an efficiency of 80 per cent for the generator. The thermoelectric couples employed in this apparatus, the inventor says, are made up of a special alloy, the composition of which is kept secret.

TELEPHONE BUREAU OF INFORMATION.—The Cuyahoga Telephone Company, Cleveland, Ohio, has evolved a new idea which will doubtless be appreciated by subscribers. It has established a bureau of information for its subscribers who have questions to ask regarding market prices, ball scores, railway and steamboat schedules, locations of fires, etc. A special operator will take care of the work, to whom all inquiries of this nature will be referred.

THE BELLE ISLE SUBMARINE CABLE.—It is asserted that the Canadian government will not be able to lay the projected submarine telegraph cable to Belle Isle on account of the monopoly of cable and telegraph rights in Newfoundland and its dependencies held by the Anglo-American Telegraph Company. It is suggested that the Marconi system of wireless telegraphy might be used with more satisfactory results, on account of the great liability of damage to a cable by ice.

COLLARS FOR MOTORMEN.—A despatch from Milwaukee, Wis., of Aug. 5, says: President John I. Beggs will issue an order to-morrow that motormen on the electric lines shall not wear celluloid collars. Because his collar was celluloid Charles Sanders was injured so seriously to-day that his recovery is doubtful. Sanders is a motorman on the Waukesha line. Near North Greenfield the motor burned out. While he was tinkering with it the controller came in contact with his collar. There was a flash, and a ring of fire encircled his neck in an instant. The motorman is suffering terribly from his injuries.

THE PARIS EXPOSITION.—Prof. E. Mascart announces that at the Paris Electrical Congress, reports will be presented as follows: Dynamo Electric Machinery, Prof. S. P. Thompson; Units, Hospitalier; Photometry, Violle; Asynchronous Generators and Compounding of Alternators, M. Leblanc; Rotary and Rectifying Converters, P. Janet; Use of Condensers, P. Boucherot; Tramway Current Supply, Postel-Vinay; Electric Lamps, Blondel; Electro-chemistry, Bouilhet; Calcium Carbide Furnaces, Gen. Sebert; Wireless Telegraphy, Blondel and Capt. Ferrié. These reports will be printed and distributed to members.

TESTING THE HOLLAND.—A special despatch from Newport, R. I., of Aug. 11, says: The submarine torpedo boat Holland was managed exclusively by a naval crew for the first time to-day. Lieutenant Harry H. Caldwell was in charge, and under him were enough picked seamen to manage the boat. Captain Cable, who brought the Holland here and has been in her in all her experiments, was on board, with several men, but merely as a precautionary measure. He was merely a spectator, and when the Holland returned to the torpedo station he complimented her crew. The Holland made ten dives. Her best run was half a mile at a depth of fifteen feet.

ARGENTINE REPUBLIC.—An electric carbide of calcium factory is being erected by a London firm in Cordoba. The force for operating the establishment is supplied by an electric power house which was erected some months ago by an Englishman at Casa Eamba, in the Cordoba Mountains. The factory covers 5 hectares of ground and is about 2 kilometers distant from the city limits, the power being brought from Casa Bamba by means of cables. The works will be under the supervision of Viscount Eugene de Boismenu, whose name is prominently indentified with the manufacture of acetylene gas in France. Cordoba is regarded as an ideal location for an establishment of the sort indicated, as it furnishes abundant supplies of lime and charcoal. When this factory is in full operation it is estimated that the current required will be fully equal to 3,000 horsepower.

MUNICIPAL LIGHTING IN SAN FRANCISCO.—Eastern capitalists, represented by A. E. Brooke Ridley, recently made an offer to install an electric lighting plant for the city of San Francisco at a cost of one million dollars. They agree to build a complete electric lighting system and to supply 2400 arc and 5000 incandescent lights for $275,000 per year for twenty years, and at the end of that term to turn over the entire plant to the city free of cost. The Independent Electric Light & Power Company has amended its proposition to build a pole line and distributing system and give it to the city at cost by agreeing to submit a bid for light at not to exceed 27½ cents per arc light per night for twenty years. This would cost about $225,000 per year, exclusive of the pole and wire system. The cost of lighting the city this year is $265,000. Only 786 arc lights are in use, the remainder being gas.

GUTTA-PERCHA AND THE PACIFIC CABLE.—The scarcity of gutta-percha, which is one of the most essential materials used in submarine cables, is evidently causing anxiety among the promoters of the English Pacific cable scheme. An Ottawa correspondent refers to a cable despatch received there from London, in which it is stated that this question of gutta-percha supply is the greatest obstacle yet encountered in the development of the enterprise. Gutta-percha, of which 2000 tons are needed for the cable, has gone up from 75 cents to $1.90 per lb., and is so scarce that no contractor will dare to bind himself to tender within a specified period. This scarcity of gutta-percha, it is alleged, is traced to the Eastern Telegraph group, who hope thus to defeat the Pacific cable plans. When the Eastern group saw the Pacific cable tenders coming out, they gave orders for about 14,000 knots of cable, and so choked the sources of production. Other large cable orders have also been placed on the market.

INDEPENDENT TELEPHONE MOVEMENT IN NEW ENGLAND.—Some interesting statistics of the development of the independent telephone movement in the New England States are given in the annual report of President Chas. E. Adams, of the Boston & New York Telephone & Telegraph Company. Mr. Adams states that a large amount of preliminary work has been accomplished for the establishment of a telephone exchange in Boston and

other points in Massachusetts, together with the construction of a toll line between Boston and New York. A large portion of the company's subscriptions are for commercial purposes. Rights of way between New York and Boston have been acquired for a toll line and the company has secured telephone franchises and rights of way in fifty-five cities and towns in New England. A model exchange has been constructed in Stoughton. The Boston & New York Telegraph & Telephone Company is one of the sub-companies of the Telephone, Telegraph & Cable Company of America.

COMBINED TELEGRAPH AND TYPEWRITING MACHINE.—A Milwaukee correspondent informs us that Zalmon G. Sholes and Alfred C. Gilmore, both Milwaukee men, have invented a combined typewriter and telegraph instrument, after five years of incessant labor. The machine only requires the service of one operator, the sender writing on the typewriter as he would on an ordinary machine, while at the other end of the line the machine is worked automatically, all that is needed being the services of an attendant to take the finished sheets from the electrical writer. The chief advantage that is found in the machine is the absolute accuracy of its work. The peculiar feature of the invention is the manner in which the messages are sent. The letters used on the sending machine are transformed into the Morse alphabet of dots and dashes, and at the other end of the line the receiving machine transmutes the dots and dashes back into the ordinary type. The device, it is said, can be fitted to any machine, and is just as much the more valuable on this account.

WELDING PIPES.—At the congress of the Saxon associations of engineers and architects just held at Leipzig, Mr. Max Schiemann, of Dresden, delivered a lecture, accompanied by experiments, on the Goldschmidt process for obtaining high temperatures and its practical application. He compared this new process with those hitherto used for heating metals for welding. He showed by experiments the new method of welding cast-iron gas pipes of 2 to 4 ins. in diameter, and demonstrated the application of the process and its result. Briefly stated, it consists in mixing powdered aluminum with oxide of iron and adding to it an easily ignitable substance. This powder is put into a clay crucible and then ignited by means of a match. The resulting chemical action renders the mixture liquid, and this liquid is then poured around the place to be welded. The object assumes a white heat, and the welding is done by a very simple apparatus. The welded places show the same firmness as the original piece, and manifold application of the method is possible. It is proposed to weld the rails of the electric tramway at Dresden, which has already been done in other cities. The speaker welded rails before the audience, and the experiments were pronounced very successful, especially on account of the simplicity of the process.

THE CHICAGO STOCK QUOTATIONS.—Another phase of the fight between the Chicago Board of Trade and the telegraph companies has developed in Kansas City, where Judge Henry has just granted a permanent injunction in favor of two commission houses in that city against the Western Union and Postal Telegraph Companies, restraining them from discontinuing the sending of grain quotations to the complainants. Judge Henry holds that the quotations are impressed with a public interest and that the telegraph companies handling them must deliver them to those who desire them, whether they be sent by parties operating leased lines or be contained in private telegrams. He further holds that these quotations are of a public nature and cannot be converted to private use to the exclusion of the public. The Western Union and Postal Telegraph Companies intend to join their interests in an appeal to the Federal courts for the dissolution of the injunction granted by Judge Henry in Kansas City. Meanwhile both companies will ignore that part of the injunction which compels them to furnish the quotations, on the ground that as neither company now furnishes "ticker" service the only way the service can be obtained would be by stealing private information from messages passing over the wires, thus directly violating the criminal code.

DESPATCHES IN CIPHER.—In a recent letter, a Washington correspondent of the New York *Evening Post* says: It would probably astonish many good citizens who have been reading the discussions of the genuineness of the cipher despatch received about a fortnight ago from Pekin and purporting to have come from Minister Conger, to know that so clever and alert-minded a man as Secretary Hay has never mastered the cipher in use by the Department of State. On the other hand, his son Adelbert, now consul at Pretoria, can handle it with ease. Ambassador White, in Germany, uses the cipher freely; as far as is known, Ambassador Choate, in England, has never learned the art. Probably very few of our diplomatic representatives can use the cipher themselves. As a rule, they have some minor functionary at each legation who has mastered the code, but in at least one case the cipher work is all done by an outside hireling, who has no direct connection with the Federal service. This state of things does not necessarily argue neglect or laziness on the part of the ambassadors and ministers concerned or of the attachés of higher rank, nor is it an inevitable fruit of the frequent changes of personnel in our foreign service. To a large extent, it is merely a question of a peculiar mental adaptation differentiated in individuals, and involves the same principle which is illustrated in one man's talent for acquiring a foreign language in a month, or the skill of another in mathematical calculations almost without study.

POWER TRANSMISSION IN ENGLAND.—Reference has frequently been made in these columns to the various English electric power bills, and we have already announced the passing, by the select committee of the House of Commons, of the Lancashire, Durham and the South Wales electric power supply bills. A similar result has been attained in the case of the North Metropolitan power bill, which has been reported for third reading in the House of Commons. This scheme is not of such a comprehensive character as some of the others, but it is still of considerable importance in the vicinity of London. It is proposed to erect a large generating station on the banks of the Lea, to lay mains through various districts, and to supply electric energy over an area approximately of 18 square miles. The two-phase alternating-current system will be adopted, the voltage being 10,000, and at first a capacity of 6000 kilowatts is to be installed. It is calculated that the cost of production will be under 2 cents per unit, and they hope to sell annually about 13 million units. The alternating current will, of course, be transformed down for lighting and power purposes, and for the operation of tramways it will be converted into 500-volt continuous current. The particular feature about this scheme is that the promoters do not intend to sell current directly to the consumers, but they intend only to sell electric energy in bulk to local authorities already possessing electric lighting powers and to tramway and light railway companies. The ordinary consumer will thus be provided with current in the usual way by the local authorities, and it is considered that the promoters of this scheme can furnish local authorities with current cheaper than they themselves can produce it.

THE "TWO-PENNY TUBE."—A special cable despatch from London quotes the following: "We live in hopes of witnessing the day when not an omnibus will remain to afflict the eyesight, obstruct progress, destroy the nerves or try the temper of the long suffering Londoner." Such is the statement made by the *Westminster Gazette,* but this is nothing to what that journal goes on to say. "What we want," it adds, "is a complete and universal system of electric tramways, not merely a line here and there fooling around in the wilds of Shepherd's Bush and other remote and unfriended districts, but swift, smooth running, well lighted, properly ventilated cars, traveling London through and through in all directions, mounting Ludgate Hill, spinning around the Bank, flying down Cheapside and generally bringing London into line in this respect with every other self-respecting city, town and, we might almost say, village in the world." When the dyed-in-the-wool Londoner, whose life has been spent on the top of an omnibus, talks about electric cars flying down Cheapside and spinning around the Bank one must believe that the town is awakening. Nothing has done so much to open the eyes of Englishmen to the advantages of electric traction as the new underground railway. The "two-penny tube" and its trains are overcrowded. It has been a success from the day it was opened, a fortnight ago. The shareholders in the 'bus companies are nervous, for the "two-penny tube" is drawing heavily from their traffic along the line of route.

SELECTIVE MULTIPLEX TELEPHONY.—Mr. Ernest A. Faller, a German residing in San Francisco, has secured a patent on multiplex telephony, the idea of which consists broadly in causing the instruments which are to be used in transmitting the conversation to sympathize or agree as to their electrical conditions when the same are brought from their condition of rest or inactivity into use and at the same time causing certain adjustments to take place

in all the instruments which are not wanted, so that upon the next pair of instruments being brought into use their electrical conditions, while mutually harmonizing, will differ from those of the pair already in use, and this same action takes place in respect to the idle instruments whenever another new pair of instruments is brought into use. Hence any idle instrument at one end of the line can establish communication with any idle instrument at the other end of the line while a conversation is being carried on between the active instruments. This he accomplishes by providing the several branches leading from the terminals of the line with condensers whose individual capacities may be varied or adjusted, induction coils the electric condition of whose secondaries may be changed by bringing in more or less turns, and receivers provided with double windings capable of being worked in series or in multiple. By means of a special switch he connects the independent windings of the said receiver in multiple or in series, the said switch simultaneously reducing or increasing the capacity of the condenser and the number of turns of the secondary coil in the inductorium in the ratio of, say, one to two or one to three, and thus changing the condition of the instrument both as to capacity and resistance, so that said instrument may be used in the transmission of articulate speech with another instrument in which like conditions exist as to capacity and resistance, but with no other. The active surface of the condenser, the number of turns in the secondary coil of the inductorium, and the windings of the receiver are proportioned in such a way as to cause the receiver to respond only to a current of a certain tension and amperage. For instance, if the switch is in such a position as to connect the windings of the receiver in series and the entire surface of condenser and winding of the secondary in circuit a current, coming from a station in whose instruments like connections and conditions exist, will cause the receiver to respond, while a current emanating from a station in whose instruments different connections and conditions exist will leave the said receiver silent, or practically so.

LETTERS TO THE EDITORS.

A Word for Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—You had an editorial reference recently to wireless telegraphy, and in commenting upon the situation in China and South Africa suggested that it was time some use was made of wireless telegrams. If the system was any good, you thought it time that the advocates and inventors of wireless telegraphy were heard from and proved their claims. This is pertinent and just.

When Signor Marconi was in the United States last fall he had the opportunity of testing his wireless telegraphy at the yacht races for the America cup, and the success obtained then in times of peace induced him to remark, "I'd like to try the system in a war." His second visit to this country now comes after an interval of six months of severe fighting in South Africa, where his system of wireless telegraphy has been in use on land and sea. The test in time of war has proved even more interesting and important than in the international yacht races off Sandy Hook.

Signor Marconi did not go to South Africa personally, but several of his assistants went there with several outfits of wireless telegraphy, and they operated in conjunction with the fleet patroling the coast. They confined their attention exclusively to sending messages between the several warships and between the fleet and the shore. At Delagoa Bay the British admiral sent messages a distance of 80 miles to the fleet off-shore. The British battleship Hannibal also sent and received messages to and from the battleship Jupiter, when under way, over a distance of 32 miles. One message was sent 100 miles, the greatest distance successfully covered.

While there were none of his assistants with the land forces in South Africa, his system of telegraphy was used by Lord Roberts, and a modification of it by General Baden-Powell. Generals White, Buller and other English officers did not take kindly to the new invention, and instead of using the instruments sent to them for all they were worth, they relied upon the old-time heliograph. It was this prejudice against the new invention that kept wireless telegraphy so much in the background during the early stages of the campaign, and it is possible that it would have received scant notice in the South African campaign had not Lord Roberts assumed command. He was not a kind to keep anything that would serve his purpose in the background simply because it had never been tested in the past. Upon assuming command in South Africa he summoned a body of wireless telegraphers and kept them in his camp all through the struggle. These experts kept him in touch with the various units of his enormous army, and some of the messages were sent overland a distance of 60 miles. There are ten sets of instruments in Lord Roberts' army, and these have been developed successfully. All scientific questions and experiments made by a rapidly-moving army are of necessity scantily reported by a commander in the field, and the accounts of the tests with the wireless telegraphy are still quite vague. Considerable interest will be shown in the official reports of the operators when the war has terminated, and no one will hail the accounts of the experiments with more concern than the inventor.

One important improvement in the system in war times was made through the co-operation of the hero of Mafeking. The difficulty of sending messages any great distance in a mountainous country like South Africa was overcome by the invention of a system of kites by Baden-Powell. In order to make wireless telegraphy successful it is necessary to raise the wire attached to the instrument to a considerable distance in the air. Thus to telegraph 60 miles, the elevation of the wire should be at least 100 feet above the surface. It was often impossible to find any way to secure this altitude for the wires, but by using the kites the problem was easily solved. Kites of the Baden-Powell type consequently became inseparably associated with the wireless telegraphy in South Africa, and it was by this means that messages were sent a distance of 60 miles.

Signor Marconi expresses himself satisfied with the experiments made in the war, and so far as the reports have been received they are nearly all favorable in their results. Both the British and Italian navies have adopted his system, and others are experimenting with it for the purpose of using it should it prove satisfactory, including the United States navy. In the meantime, some of the big transatlantic steamship companies are using the system, and one of the inducements offered their patrons is of communicating with friends on shore long before the steamers reach port. Several hours are saved in this way on both sides of the Atlantic in receiving the latest news of the day which may have transpired on two continents while the passengers were on the sea.

G. E. W.

NEW YORK CITY.

The Doherty Rate System.

To the Editors of Electrical World and Engineer:

Sirs:—At the Chicago convention of the National Electric Light Association in May, Mr. Henry L. Doherty read a paper entitled "Equitable, Uniform and Competitive Rates," and proposed new methods of charging which seemed rather revolutionary. The distinctive features of the "Doherty Rate System" are:

1st. That consumers shall be charged the cost of "readiness to serve," and that current shall be charged for in addition to this at a slightly greater rate than cost to generate.

2d. That this charge shall be based principally on the capacity demanded.

3d. That the consumer shall determine the capacity he needs and the station shall limit this capacity to the amount paid for by means of a fuse, circuit breaker or interrupter.

This paper seriously disturbed my former ideas regarding various methods of charging, and being unable to find counsel in the columns of the electric press, I entered into correspondence with the author of the system, and I now find myself in the position of the "man convinced against his will."

Mr. Doherty has repeatedly charged that the advocates of the other systems cannot successfully defend them, and has practically issued a challenge to them all. Will you please invite comment in your columns on the negative side of the "Doherty Rate System" and help solve a question which is of vital interest to the central station industry.

A CENTRAL STATION MAN.

MONTGOMERY, ALA.

Dangers of Gas and Electricity.

To the Editors of Electrical World and Engineer:

Sirs:—A great deal has been written about the danger to life from electric current, and every case of death from electric shock is reported throughout the country. A hundred people may be asphyxiated by gas at different hotels throughout the United States in a single

night, and yet it scarcely receives mention in the news columns of the daily papers.

There was an item headed "Dangers of Electric Lighting" in the *Lancet Clinic* of Aug. 4, which is being given wide circulation by some of the gas companies in this country.

There is no question that the number of fatalities due to asphyxiation from gas is many times as great as the fatalities due to electric shock. The fatalities due to asphyxiation are almost wholly from the ranks of the general public; the fatalities due to electric shocks are almost wholly from the ranks of electric light company employees.

I believe that one of the greatest benefits your paper could confer upon the electrical fraternity would be to present a careful tabulation of the facts as to the number of fatalities in the United States for the year 1899 from these two causes, dividing the number in each case into the fatalities among employees and the general public, respectively.

GENERAL MANAGER.

OHIO.

Approaching a Station on Up-Grade.

To the Editors of Electrical World and Engineer:

Sirs:—In connection with the articles which have recently appeared describing the London underground system, it may be interesting to note that one feature of this which has attracted a good deal of attention is not as new as is commonly supposed. I refer to the arrangement of grades by which the station is approached on an up-grade, the train departing always on a down grade. I supposed that this ingenious arrangement was due to Sir Benjamin Baker; and I still suppose that it was original with him. But I find that it was not new.

In the English patent to Jensen, No. 395 of 1883, dated the 24th of January, I find a description of this arrangement. In accordance with the English custom the patent was issued to the solicitor, in this case on the communication to him from Frederick Hahn Danchell, a French engineer. On page four, beginning at line 53, is this statement: "In order to stop the train or engine at the desired point or terminus the electrical continuity of the upper rail *B* is interrupted at such place by an absolute break in the rail, or by a piece of insulating material inserted in such break, so that the dynamo machine does not supply current to such insulated upper rail continuation. But in order to stop the train more quickly, the railway is made with a suitable ascending slope at such part," etc.

It might be said that this does not completely describe the idea, as it says nothing of the down grade assisting the start; but unless it were possible to build a railroad all up-hill both ways, the practical embodiment of Danchell's suggestion would contain all the features of this part of the Central London construction.

NEW YORK CITY. T. J. JOHNSTON.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

Synchronous Converters.—WILSON.—A brief account of some experiments made with a 11-kw bipolar two-phase synchronous converter with smooth core drum armature, in order to find out how the field excitation must be varied for varying load, if the converter is run at constant frequency, with constant potential difference between its slip rings at all loads and maximum power factor. The generator excitation had to be increased as the load was increased, while the converter excitation showed a diminution of about 2 per cent, as the load was increased from 0 to 8 kilowatts. These results, obtained with a two-phase machine, are opposed to those obtained by Parshall and Hobart with a three-phase synchronous converter; they found that the field excitation had to be increased as the converter was loaded, the excitation at full load being about 15 per cent greater than at no load.—Lond. *Elec.*, July 27.

Designation of the Power of Alternators.—A brief article in which he points out that the designation of the capacity of an alternator or transformer in kilowatts is irrational. He suggests to give the apparent power in volt-amperes or kilovolt-amperes.—*L'Elec.*, June 23.

REFERENCES.

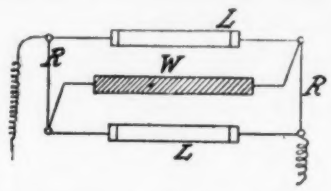
Induction Motors.—FISCHER-HINNEN.—The first parts of what promises to become a very long paper in which he shows how to calculate an induction motor in the shortest way, and illustrates the meaning of the formulas by numerous tables and examples. The paper is fully illustrated.—*Zeit. fuer Elek.*, July 15, 22.

Alternators Connected in Parallel.—GOERGES.—A long illustrated French abstract of the German paper, noticed in the Digest Apr. 7.—*L'Eclairage Elec.*, June 2.

Synchronous Motors.—EICHBERG.—The conclusion of his illustrated paper in full, on the influence of the resistance and reactance of the line upon synchronous motors (Digest, July 7).—*Zeit. fuer Elek.*, July 1.

LIGHTS AND LIGHTING.

Nernst Lamp.—F. SCH.—A continuation of the illustrated serial on the development of the Nernst lamp, abstracted in the Digest Mar. 24, Apr. 14, May 26. A great drawback of the most Nernst lamps are the more or less complicated devices required for switching out the heating body after the incandescent body has been heated up. Menganini has invented a simple means by which such a device becomes superfluous, as the heating body remains in circuit, but there is no current flowing any more through it after the incandescent body has been lighted. His arrangement is based upon the principle of the Wheatstone bridge, as illustrated in the adjoining figure, where *L* and *L* are electrolytic incandescent bodies and *W* is the heating



SWITCHING ARRANGEMENT, NERNST LAMP.

body and *R* and *R* are resistances chosen in such a way that no current is flowing through *W* after the incandescent bodies have been lighted. Similar arrangements based upon the same principle are also noticed. Macdonald suggests to cover the incandescent body with a thin layer of a conducting and easily combustible material, or to use an incandescent body in the form of a hollow cylinder, in which two quickly combustible arc lamp carbons are placed, so that when the current is supplied to this lamp, an arc is formed between the carbons, the electrolytic incandescent body is heated; in the meanwhile the carbons are consumed and the arc is extinguished; such devices can be used of course only once, and must be replaced after having been used once. This is not necessary in another lamp of Macdonald, where the incandescent body has also the form of a hollow cylinder; the heating body is a wire placed in the cylinder so that it does not touch the incandescent body; one end of this wire is connected to the positive feeder, the other end is in contact with the end of the incandescent body as well as with a thermostat consisting of two metallic strips of different coefficients of expansion and connected with the negative feeder; when heated, the thermostat stretches up, its contact with the heating wire is broken, and the current goes now from the positive feeder through the heating wire and back through the incandescent body, the other end of which is connected with the negative feeder; the heating wire is thus now in series with the incandescent body. A lamp of Van Deventer is noticed, in which, after the incandescent body has been heated up, the heating body is used somewhat like an electrode for supplying the current to the incandescent body. The lamps of Van Vleck and Boehm are also described and illustrated from American patent specifications (see ELEC. WORLD AND ENG., Mar. 17, p. 405, and Mar. 10, p. 369).—*Elek. Anz.*, July 22.

Train Lighting.—SHEPARDSON.—A very long and fully illustrated

paper read before the Northwest R'y Club, St. Paul, Minn. He discusses briefly the different sources of light: candles, oil, gas, electricity, and the relative costs of the different systems. He discusses at great length the amount of light and distribution of the sources required for passenger cars, and gives the results of extended tests of the amount and distribution of light in cars as actually found in the practice of various railway companies. The results of these tests are given in diagrams and are discussed in detail. The general conclusions are as follows: The average illumination by the different systems is for gas and electricity combined 2.89 candle-feet, for electricity alone 1.98, for gas alone 1.005, for oil 0.545, for carburetted air 0.44. The comparison in regard to uniformity of illumination gives the following ratios between minimum and maximum values in any one car: gas and electricity combined 0.528, electricity alone 0.457, gas alone 0.410, oil 0.338, carburetted air 0.102. Another comparison of interest is the variation of illumination at adjacent seats; in this regard sleepers cannot be compared with other cars on account of the different arrangements of the seats; in cars other than sleepers, the values of the larger illumination divided by the smaller at the point of greatest variation, omitting end seats, are as follows: electricity 1.25, gas and electricity 1.31, gas 1.63, oil 1.84, carburetted air 2.33. The great advantage of electric light is here shown, as it comes first in point of uniformity, a result of using many lamps of small candle-power instead of a few lamps of large candle-power. His final conclusion is that the electric light appears to be the best of all the lights. In the figures given above it comes first in regard to uniformity in adjacent seats, and second in regard to uniformity throughout the car, but could be made first in this respect also with a better arrangement. The average of 25 curves shows a good illumination amounting to nearly 2 candle-feet. By a skillful arrangement of side and centre lights, the wall and aisle seat curves can be brought very close together. Care must be taken, however, in placing the side lights; they should not be placed lower than 7 ft. from the floor, unless each seat has it own lamp protected by a shade or otherwise so as to prevent the glare. The use of both gas and electricity seems useless, as electricity has all the advantages of gas, and more.—*Off. Proc. Northwest R'y Club* (St. Paul), May.

Base of Incandescent Lamps.—Montpellier.—An article in which he discusses the disadvantages of the usual base of incandescent lamps and describes an arrangement of Hollub in which the glass bulb ends in a narrow part, provided with two small metallic plates connected to the filament; as these two plates are separated by glass, there is no danger of short circuits. To place this lamp into a socket, a separate base is used, consisting of a brass cylinder with several slits at its upper part in order to embrace the glass bulb. The details of the arrangement are given in diagrams. The process of manufacture is said to be quicker and cheaper than with the usual base.—*L'Elec.*, June 23.

Traction.

Measuring Instrument for Tramways.—Kapp.—The cut belonging to the abstract in the Digest Aug. 11, was printed in a wrong position. The whole cut should be turned around point *a* by the angle $\propto$ so that *ab* is inclined against the horizontal line by the angle $\propto$ and the line *E B* is parallel to the horizontal line.

Capacity of Storage Batteries for Automobiles.—Loppe.—A brief article developing a simple formula for calculating the storage batteries required for an automobile. He assumes that a battery of 44 cells is used, which gives an e. m. f. at the terminals of about 85 volts. The average consumption of energy for a well designed automobile is about 85 watt-hours per ton kilometre, so that on the average 0.001 ampere-hour is required per kilogram kilometre. If m is the ratio between the weight of the loaded automobile and the weight of the battery, the specific capacity of the battery required, in ampere-hours per kilogram of total cell, is equal to m multiplied with the number of kilometres which the automobile has to run at one charge multiplied with 0.044. For an ordinary automobile m is about 3, for a specially constructed vehicle it is possible to get a value of m which is about 2. An ordinary automobile, for which m is equal to 3, provided with a battery giving 10 ampere-hours per kilogram of total cell, can run over 75.6 kilometres. In order to run over 250 kilometres (155 miles), a specially constructed automobile, for which m is equal to 2, must have a battery of the specific capacity of 22 ampere-hours per kilogram of total cell (or about 10 ampere-hours per pound of total cell).—*L'Elec.*, July 7.

Train Resistance.—A long editorial calling attention to the fact that the formulas for figuring the resistance of trains at high speeds differ greatly. This is shown in a numerical example. The writer believes train resistance to depend upon so many things that it is not safe to assume that it can be figured from a simple formula. The three principal factors are the track resistance, the drag of journal friction and the air resistance, which is more complex than the other two, being rather small at low and moderate speeds, but very important at high speed. Each of these factors can be separated into several others, which are mentioned and discussed. The air resistance is composed of two distinct parts: the head pressure and the eddy or wave pressure along the sides. The writer thinks that the latter passes through a series of maxima and minima, depending on velocity, length of train and other factors. He also thinks the number of geared axles has an important effect on the result, as the grinding friction of a driving wheel is entirely different from the rolling friction of a trailing wheel. He advocates tests on all these points, these tests to be plotted graphically instead of endeavoring to derive a formula, and predicts that the total resistance of a well designed train weighing 100 tons and operating at 100 miles per hour will not exceed 20 lbs. per ton of weight.—*St. R'y Jour.*, Aug. 4; *Int. Ed.*, August.

Street Car Brakes.—An abstract of the official report of the New York Railroad Commission on tests of street car brakes. Among the brakes tested four were electric. A brake of the Elec. Selector & Signal Co., operated by the trolley current, consists of a series of magnets, the armatures of which are at varying distances from the magnets, all mounted loosely on the same rod and in such a manner that the attraction of the armature nearest to the core carries with it the armature next in distance from its core to a point of greater magnetization, and so on, each armature acts upon the next, thus creating a long and powerful pull; these armatures are arranged on a rod which forms a part of the ordinary brake rod; this brake can be applied to the ordinary spindle hand brake; the movement of brake handle sets the electric brake in operation, and this movement can be continued, setting up the shoes by hand without interference from the electric portion of the brake, so that in case of failure of the current, the brake can be set by hand; the hand brake is under test at all times when the electric brake is used, thus insuring it being in working condition in case of failure of the trolley current. A brake of the General Electric Co., which is in use on several lines, has the following construction: Each motor is fitted on the commutator end with a cast-steel yoke provided with two horns which project on each side of the axle and support the brake shoe; this shoe is 26 ins. in diameter, and consists of two cast-iron halves, a crescent shaped slot being cast in each half, which holds the energizing coil; the disk, with which the brake shoe is drawn into contact, when energized, is cast as a part of the car wheel; the braking is accomplished by converting the motors into generators and passing the current thus generated through the brake shoes and a regulating resistance; the braking effort is due partially to the back torque of the motors acting as generators and partially to the friction between the shoes and the wheel disks; the brake shoe on each axle is directly in series with the armature of the motor on the same axle. Two other electric brakes were also tested by the commission, but as they did not meet the requirements of the tests, no description of them is given.—*Eng. News*, Aug. 2. (See Elec. World and Eng., Aug. 11.)

References.

Havana.—A long, very well illustrated description of the electric railways of Havana, now under construction. There will be about 80 miles of track. The form of the standard cars, the track construction, the overhead construction and the plan of the power station are illustrated in numerous drawings.—*St. R'y Jour.*, Aug. 4; *Int. Ed.*, August.

Geneva.—A long illustrated article on the street railway system of Geneva, Switzerland, which is now being equipped electrically, as noticed in the Digest June 16.—*St. R'y Jour.*, Aug. 4; *Int. Ed.*, August.

Tramway Power Station Design.—An editorial discussion of the paper of Dawson, abstracted in the Digest July 28.—*Lond. Elec.*, July 27.

Tramway Motors.—A general illustrated description of tramway motors of the Helios Co.—*Elek. Rund.*, June 15.

Electrolysis of Water Mains.—An abstract of the report made by Knudson to the water department of Providence, R. I. He has made a number of potential tests which show that the tramway return currents pass through the water mains.—*Eng. News*, Aug. 2.

Breaking of Trolley Wires.—Drescher.—An illustrated article dis-

cussing the causes which may bring about the breaking of a trolley wire, and giving hints how to prevent it.—*Zeit. fuer Elek.*, June 10.

Automobile Exposition.—PAUL.—An article on the electric automobiles on the motor car exposition which was held during the month of June in Nuernberg.—*Centralblatt fuer Accum. und Elem. kunde*, July 15.

Motor Cars.—STOBRAWA.—A paper read before the Elektrotechnical Society of Cologne on the development of the motor car for electric street railways.—*Elek. Anz.*, July 15, 22.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Willesden.—The first part of a long article giving the full details of a scheme for the combined lighting and traction plant in the district of Willesden, near London. This is the first scheme in Great Britain in which it has been definitely proposed to use double-current generators, generating both three-phase and direct currents. The district is divided into three approximately equal sections, each of about two and one-third square miles in area. In one section the power plant is located, and in each of the others a converter and battery sub-station. Three-phase currents at high pressure are used for transmission from the power plant to the sub-stations, where they will be converted into direct current for distribution.—Lond. *Elec.*, July 27.

Induction Motor Plant.—A long, well illustrated description of the plant of the Deering Harvester Co. in Chicago, which is said to be the largest isolated plant of induction motors in the world. Three-phase current is used, the frequency being 40. There are at present 65 induction motors in service aggregating about 4000 horse-power, and an addition of some 1000 horse-power more is already planned; the sizes are between 20 and 100 horse-power. There is no individual application of motors to machines, but the motors in all cases drive line shafting by which the power is distributed from one motor to several or many machines.—The article is discussed also in an editorial.—*Am. Elec.*, August.

Southport.—The first part of an illustrated description of the combined lighting and traction station of Southport. For the tramway 500-volt direct current is used, while the lighting system is a single-phase alternating one, current being generated at 2000 volts and transformed down to 100 and 200 volts, the former pressure being for a two-wire supply from sub-stations in various parts of the town, and the latter for outlying districts.—Lond. *Elec.*, July 27.

REFERENCES.

Baku.—HORSTMANN.—An illustrated article on the generation and distribution of electric energy for driving electric motors and for lighting purposes in the naphtha districts of Baku.—*Elek. Anz.*, July 15.

Automatic Reversing and Starting Resistances for Elevators.—An illustrated description of a device of the General Electric Co. of Berlin for direct current at 500 volts and shunt wound, series wound or compound electromotors of 8, 15 and 30 horse-power. For starting the stopping device is released and the speed at which the weighted contact maker sinks down is automatically regulated, so that the starting resistances are gradually switched out.—*Elek. Anz.*, July 19.

ELECTRO-PHYSICS AND MAGNETISM.

Theory of the Coherer.—GUTHE and TROWBRIDGE.—After a brief summary of previous work of other authors on this subject, they point out that the phenomenon of coherer action can be best studied only when sparking is avoided; under this condition the action of the coherer is very regular. They describe experiments in which they were careful to avoid all disturbing influences; the results are given in diagrams and tables. They conclude that from their investigation and from the work of other observers it seems to be justifiable to attribute the high original resistance of the coherer to films on the surface of the metallic particles; the films form a sort of protecting layer. Reference is made to the results obtained by Aschkinass with coherers consisting of peroxide of lead or sulphide of copper particles, and mentioned as a proof against Lodge's theory, as they behave in the opposite way from the ordinary coherer; the present authors suggest, in view of the similarity with polarization, that the compounds are in this case broken up into two components, one of which conducts well and the other poorly; no actual metallic contact need then occur, and the S or O would play a decided part in the increase of resistance. It seems that particles of any conducting substance may form a coherer, among other carbons; possibly cohesion plays a part in the starting of an electric arc.—*Phys. Rev.*, July.

Coherer.—DELL.—A communication on coherer action. When two points are used between which sparks pass they become tarnished or covered with deposits, some metals more than others. The point on the negative side becomes more tarnished that the one on the negative, and the sparks do not pass as well as when they are bright. If the points are shifted when tarnished, the positive to the negative and the negative to the positive, the resistance to the passage of the sparks is increased.—*Elec. Rev.*, July 25.

Thermoelectricity of Nickel Steel.—STEINMANN.—A note stating that the announcement of the high thermo e. m. f. of nickel steel, containing 28 per cent of nickel, was incorrect, as an authentic example of such steel, forwarded to Steinmann by Guillaume, did not show the announced high value.—*Comptes Rendus*, July 2; abstracted in Lond. *Elec.*, July 20.

Point Discharges.—WARBURG.—A paper in which he describes the following experiment which shows the difference between positive and negative ionization. He keeps a point at a constant potential face to face with a large plate connected to earth, and arranges the supply from an influence machine in such a manner that the glow is confined to the immediate neighborhood of the point. With the use of very carefully purified nitrogen as a medium, the current intensity obtained by charging the point to —3310 volts is 200 times as great as that obtained with + 5180 volts. This enormous difference was reduced to a ratio of 4 : 1 by a slight admixture of oxygen. He accounts for this by Thomson's theory of corpuscular ionization.—*Ann. der Physik*, No. 6; abstracted in Lond. *Elec.*, July 27.

Absorption and Ionization.—MCLENNAN.—An account of experiments which prove the following law: When cathode rays of a given strength pass through a gas, the number of ions produced per second in 1 cc. depends only upon the density of the gas, and is independent of its chemical composition. When cathode rays are absorbed to any extent, the number of the produced positive and negative ions bears a constant ratio to the quantity of the rays absorbed.—*Proc. Roy. Soc Abst.*, July 9; abstracted in Lond. *Elec.*, July 27.

Ionic Conductivity of the Atmosphere.—ELSTER and GEITEL.—A paper in which they apply Lenard's discovery that ultra-violet light is capable of imparting conductivity to a non-conducting gas, in order to account for the dissipation of the charge of an electroscope by ordinary air. Since the sun's rays contain ultra-violet light before they impinge upon the atmosphere, this light must ionize the upper strata, and the ions produced will be gradually distributed through the whole of the atmosphere by diffusion and convection. Hence the air will contain stray ions of both signs, possibly differing in frequency with the altitude. It is these ions which gradually discharge a carefully insulated electroscope.—*Ann. der Physik*, No. 7; abstracted in Lond. *Elec.*, July 27.

Electric Properties of Different Glasses.—GRAY and DOBBIE.—An account of a continuation of their researches on the effect of chemical composition upon the electric properties of glass. That this effect can be very great is shown by a single case, in which the resistance of a lead-potash glass was reduced 130 times by substituting soda for the potash. Barium glasses have peculiar properties; one sample had an exceedingly high resistance, another of different composition showed comparatively a very low resistance. The effect of annealing glass is greatly to increase the resistance, often to three times its original value.—*Proc. Roy. Soc.*, June 21; abstracted in Lond. *Elec.*, July 27.

Change of Resistance by Magnetization.—GRAY and JONES.—An account of some experiments with soft iron wires, which seem to prove an influence of magnetization upon the resistance of the wire. The change of resistance appears to be proportional to the fourth power of the intensity of magnetization.—*Proc. Roy. Soc.*, June 21; abstracted in Lond. *Elec.*, July 27.

Anomalous Electromagnetic Dispersion.—SCHMAUSS.—An account of some measurements of the electromagnetic rotatory dispersion in fuchsine solutions and in didymium glass, which justify the general conclusion that optical anomaly in dispersion is invariably associated with electromagnetic anomaly. In a strongly absorbing medium the anomaly extends for a considerable distance on both sides of the absorption band, and it increases with the concentration and with the narrowness and sharpness of the absorption band.—*Ann. der Physik*, No. 6; abstracted in Lond. *Elec.*, July 20.

REFERENCES.

Wave Form of Three-Phase Currents.—BRAGSTAD.—A long French

abstract of the German paper, noticed in the Digest Apr. 28.—*L'Eclairage Elec.*, June 2.

Electromagnetic Mechanism.—FESSENDEN.—Continuation and conclusion of his long illustrated Franklin Inst. paper on electromagnetic machanism with special reference to telegraphic work.—*Jour. Frank. Inst.*, July, August.

Theory of Ions Applied to Metals.—DRUDE.—A long and full account of his theory, which was referred to in the Digest Feb. 17.—*Ann. der Physik*, March; abstracted briefly in *L'Eclairage Elec.*, June 2.

Spark Length of an Influence Machine.—A communication by Von Geitler, stating that the phenomenon described by Humphreys (Digest, July 14) was already briefly described by H. Hertz.—Lond. *Elec.*, July 27.

Ions in Gases.—LANGEVIN.—An illustrated paper read before the International Society of Electricians in Paris, in which he gave a summary of our present knowledge of the ionized gaseous state. (ELEC. WORLD AND ENG., July 21, p. 83.)—*Bull. de la Soc. Int. des Elec.*, May.

Cathode Rays.—CZUDNOCHOWSKI.—A brief note stating that fluorspar is colored under the influence of cathode rays. That surface of a piece of fluorspar which is exposed to the cathode rays gets a dark color.—*Phys. Zeit.*, June 9.

Surface Electrification of Crookes and Geissler Tubes.—VILLARI.—An account of an investigation of the distribution of electric charges on the outer surface of Crookes and Geissler tubes, by means of Lichtenberg's figures. His results are simlar to those obtained by Ricke (Digest, Feb. 10).—*Phys. Zeit.*, June 16.

Eddy Currents.—WEILER.—A brief article on eddy currents. He discusses briefly the production of eddy currents in a copper disk oscillating as a pendulum between the pole pieces of an electromagnet, and shows how this phenomenon has been used in motor meters.—*Elek. Rund.*, June 1.

Coherer.—PRASCH.—The first parts of a long, illustrated article giving a summary of the work of various investigators with the coherer.—*Elek. Neu. Anz.*, June 1, July 1.

Magnetic Rotatory Polarization in Liquified Gases.—SIERTSEMA.—A preliminary account of a series of measurements, showing that the dispersion, at all events, is of the same order as that found in the gaseous state.—*Proc. Roy. Acad. Amsterdam*, May 25; abstracted in Lond. *Elec.*, July 20.

Magnetism and Temperature.—WILLS.—An account, illustrated by many diagrams, of a long investigation of the effects of temperature on the magnetic properties of iron and alloys of iron; of the latter, tungsten alloy, aluminum alloy, and a 5 per cent nickel alloy were investigated.—*Phil. Mag.*, July.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolytic Drilling and Slotting of Metals.—COWPER-COLES.—A fully illustrated article describing a method of drilling and slotting holes electrolytically. In his first experiments the electrolyte was projected onto the iron to be drilled, a strong electric current being caused to flow from the metal to be drilled through the jet of liquid and thus back to the source of electricity. This method was found to be fairly satisfactory, but the holes were not sufficiently true. A nozzle was then constructed; the opening at the lower end is pressed against the plate to be drilled; the upper end has two openings, through the one the electrolyte flows into the nozzle, through the other it flows out; the nozzle is divided into two parts by a baffle plate which reaches nearly down to the lower end; in this way it is possible to rapidly circulate the electrolyte through the nozzle round the baffle plate. A pointed rod, fitted in a gland, is so arranged as to be near the end of the baffle plate; this needle forms the negative electrode, on which the iron is deposited as a powder, due to the high current density, and is washed away by the rapidly circulating electrolyte. The end of the nozzle, which is pressed against the plate to be drilled, is fitted with a rubber washer, which can be easily removed, and the shape and size of the hole to be drilled is determined by the shape and size of the rubber washer. Some of the best results for iron have been obtained with a solution of sulphuric acid, but good work has also been done with ordinary salt water.—Lond. *Elec. Rev.*, July 27.

Gas Polarization in Storage Batteries.—STRASSER and GAHL.—A brief paper referring to the article of Nernst and Dolezalek (abstracted in the Digest June 9), in which the importance of the "surplus pressure" required for the development of gas in the lead accumulator was pointed out. They have made experiments to determine how the surplus pressure required for the development of hydrogen depends upon the material and the properties of the negative plate of the storage battery. It is a fact that for equal charging currents the e. m. f. required for charging equal types of storage batteries is not the same if the negative grids consist of hard lead or soft lead. Liebenow has remarked that this fact may be due to a difference of the surplus pressure required for the development of hydrogen. They describe experiments which they have made and which confirm this theory. The experiments were made with lead-antimony alloys in solid and spongeous forms.—*Zeit. fuer Elektrochemie*, July 5.

Electrolysis of Fused Salts.—HELFENSTEIN.—An account of an investigation of the influence of varying conditions on the current yield in the electrolysis of chlorides of lead, zinc, tin, cadmium and silver, and lead bromide and iodide. The yield required by Faraday's law could be obtained neither in a U-tube nor in any simple apparatus which allows direct contact of the anode and cathode liquids; rise of temperature, decrease of intensity of current, decrease of the distance between the electrodes, and prolongation of the electrolysis have the effect of diminishing the yield; the chief cause of the imperfect yields obtained is the solubility of the metal in its fused halogen compounds, and a consequent diffusion to the anode and to the surface of the electrolyte, where the metal is oxydized or goes off as vapor. An approximately theoretical yield can be obtained when the disturbing factors are removed: the anode and cathode are separated from each other, either by being enclosed in tubes with lateral openings, or by the interposition of a diaphragm; the electrolyte may be allowed to solidify on the surface, so as to prevent diffusion of metallic vapor into the atmosphere, and the temperature is kept as low as possible, just above the melting point of the salt.—*Zeit. fuer Anorgan. Chemie;* abstracted in *Jour. Chem. Soc.* and Lond. *Elec. Eng.*, July 20.

Potential Required for Discharging Chlorine Ions.—MUELLER.—A paper, illustrated by diagrams, giving an account of an experimental investigation made by his method, noticed in the Digest June 9. He questions the correctness of the usual statement that the potential required to discharge chlorine ions into gaseous chlorine atoms is 1.31 volt; it may be that it is 2 or 2.2 volts. The methods of measurement used to determine this potential, do not allow to draw indubitable conclusions.—*Zeit. fuer Elektrochemie*, May 31, June 7.

Electrolysis Without Electrodes.—HUSER.—An illustrated article in which he says that on account of the quick destruction of anodes by the hydrogen or chlorine deposited, an electrolytic process without any electrodes would have advantages, even if the efficiency is not very great. He suggests to form the whole circuit of the same electrolyte and to produce a current in it by causing the electrolyte to stream quickly in such a way that its motion is perpendicular to a given magnetic field. He describes different forms of apparatus for this purpose and calculates the efficiency of one of them, but does not say that he has tried it experimentally.—*Elektrochem. Zeit.*, June.

REFERENCES.

Electro-Chemistry.—MARGOT.—A long article on the progress in electro-chemistry in 1899. He gives a summary of the most important theoretical researches, the progress in the construction of primary and secondary batteries, in the design of apparatus for electrochemical processes, in metallurgy and galvanic plating, and in the design of electric furnaces.—*L'Electrochimie*, p. 45; *L'Ind. Elec. Chim.*, April, May.

Electric Furnaces for Producing Calcium Carbide.—CARLSON.—The first part of a French translation of the German article, abstracted in the Digest Mar. 17, Apr. 7.—*L'Ind. Elec. Chim.*, May.

Battery Plates.—PUMPELLY.—Three photographs of storage battery plates which had to be taken out of the batteries in accumulator cars, as they needed repairs; also some general remarks on such repairs.—*Elektrochem. Zeit.*, July.

Storage Battery.—An article on the method of manufacturing the Pollak storage battery.—*Zeit. fuer Elek.*, June 17.

Storage Batteries.—A summary of the progress made in the last 25 years in the construction of secondary batteries.—*Elektrochem. Zeit.*, June, July.

Storage Battery Cases.—SCHAERTLER.—A brief article advocating the use of cases of pottery ware for storage batteries, which are said to be preferable to ebonite cases.—*Elektrochem. Zeit.*, June.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Ballistic Oscillometer.—A and V. GUILLET.—A brief French Academy paper. They start from the rule that when a coil supplied

with a certain current oscillates in the inner part of a fixed coil supplied with the same current, the product of the current and the period of the oscillations is constant; therefore the number of oscillations during a certain time is proportional to the quantity of electricity supplied during that time; this rule is used in the counters of Vernon-Boys and Blondlot. The energy cannot be measured in the same way; to measure it, not continuous current is supplied to the oscillating coil, but only a current that lasts for a moment; let the coil oscillate around a fixed axle in a magnetic field, then it can be shown that if the magnetic field is constant, a certain angle of oscillation corresponds to a certain quantity of electricity; if the magnetic field is proportional to the e. m. f., the angle of oscillation corresponds to a certain amount of energy. The first case is obtained with a permanent magnet, the second by means of a coil, in shunt, for producing the magnetic field. The arrangement of their experimental model is briefly described.—*L'Eclairage Elec.*, June 16; *L'Elec.*, June 23.

Meters for Three-Phase Currents.—MOELLINGER.—A long article with many diagrams and illustrations. In the first part he gives a summary of the different formulas for the power in three-phase current circuits and describes connections of dynamometers based upon these formulas for measuring the power; he also shows how to apply these formulas for the construction of meters based upon Ferraris' principle. A special meter of Schuckert & Co., designed upon this principle, is described in the second part of his article. He gives seven different formulas for the power as function of the currents in the three phases and of the e. m. fs. between the three phases. Three of these formulas are considered by him thoroughly; the following abstract is restricted to the explanation of the simplest of these formulas (although the other two have some advantages for constructing a practical meter); it states that the power at any moment is the difference of two products; the first product is the current in phase 1

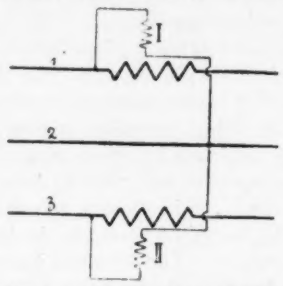


FIG. I.—METERS FOR THREE-PHASE CURRENTS.

multiplied with the e. m. f. between phase 1 and 2, the second product is the current in phase 3 multiplied with the e. m. f. between phase 2 and 3. The effective power can therefore be measured by two electrodynamometers, the series and the shunt coils being connected as shown in the adjoining figure. It can be easily seen that the two dynamometers, if properly designed, can be coupled together in such a way that the readings of the combined instrument give directly the effective power. There are, however, great difficulties in the construction of such an instrument, which are discussed. He shows how it is possible to apply the foregoing considerations for the design of a meter, based upon Ferraris' principle, and describes a meter of the Schuckert Co. designed in this way. The movable part consists of a vertical axle; at its end two aluminum disks are mounted, each rotating between the pole pieces of an electromagnet, excited by a shunt coil. At the right hand and at the left hand of each magnet there are two series coils; the two upper series coils and the upper magnet act upon the upper aluminum disk, the two lower series coils and the lower magnet act upon the lower aluminum disk. A meter based upon Ferraris' principle, in which a series coil and a shunt coil act upon a metal disk rotating between the pole pieces of a damping magnet, gives correct indications if the magnetic fields produced by the series coil and by the shunt coil are in quadrature in the case that the current of the series coil and the e. m. f. of the shunt coil are in phase; hence if the magnetic field produced by the series coil is in phase with the current, the magnetic field produced by the shunt coil must be in quadrats with the e. m. f. It is possible here to evade the difficulties arising in the production of a magnetic field in quadrature with the e. m. f.; under the assumption that the three e. m. fs. between the phases are equal and differ from each other in phase by 120 degs., it is possible to use other e. m. fs. for the excitation of the shunt coil instead of those strictly required by the formulas. It is apparent that there is a great variety of possibilities; but he shows that certain points must be considered here in order to get a strong magnetic field with a small consumption of energy. The arrangement which he adopts as equivalent to the arrangement of the above first diagram, is illustrated in the adjoining second diagram. The coil S_1 exciting the upper magnet is connected to phase 1, the coil S_2 exciting the lower magnet is connected to phase 2, both coils are in star connection with a choking coil D connected to phase 3. The two upper coils are connected in series, also the two lower series coils.

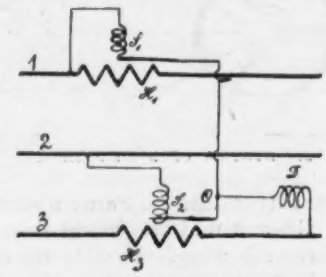


FIG. 2.—METERS FOR THREE-PHASE CURRENTS.

The construction of the meter is described in detail.—*Elek. Zeit.*, July 12, 19.

Electric Indicating Log.—An illustrated description of the McGray electric log for indicating distances steamed at sea. It consists of a rotator which constantly turns a double-thread screw; on this screw runs a nut, which, as the rotator revolves, constantly runs forward and backward from end to end of the frame. The front end carries a conical water-tight compartment, in which there are the electrical contacts operated by a push-rod every time the nut moves up to the forward end of the frame. This compartment is connected by a double-conductor cable with a battery on board the vessel, and an indicating apparatus, which is a simple revolution counter moved forward step by step by an electromagnet. In this way the counter moves one step every time the rotator turns around a definite number of revolutions, corresponding to a certain distance traversed by the ship.—*Elec. Rev.*, Aug. 1.

REFERENCES.

Measuring Instruments for Alternating Currents.—BENISCHKE.—An illustrated article on the instruments described in the Digest June 16.—*Zeit. fuer Elek.*, July 8.

Meter.—An illustrated description of a meter of the German-Russian Electric Meter Co., which is midway between the revolving motor meters and the oscillating meters. One portion of its movable parts revolves while the other makes periodic oscillations.—*Elek. Anz.*, July 12.

Testing Lightning Rods.—NOWOTNY.—An illustrated description of a method for testing the ground of lightning rods, based upon methods of Ruhstrat and Wiechert.—*Zeit. fuer Elek.*, June 3.

TELEGRAPHY TELEPHONY AND SIGNALS.

Revolving Field System of Dial Signals.—QUERENGAESSER.—An illustrated paper read before the recent annual meeting of the Union of German Elec. Eng., in which he describes the "revolving field" system of the General Electric Co. of Berlin, for sending dial signals on battleships, for instance, from the bridge to the engine room. The transmitter consists of a closed resistance coil *a* which is supplied with direct current at two symmetrically situated points *bb* by

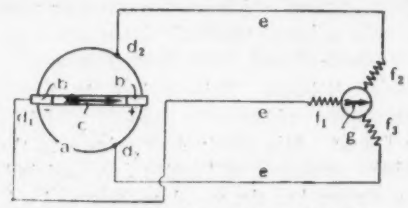


FIG. 1.—SYSTEM OF DIAL SIGNALS.

means of a pivoted lever *c*. The transmitting line consists of three wires *e* starting from the three symmetrically situated points $d_1 d_2 d_3$ and ending in three coils $f_1 f_2 f_3$ which produce a magnetic field, determining the position of the magnetic needle *g*. To transmit a signal, the lever *c* is moved; then it can be easily seen that the needle *g* will follow this movement; in the diagram the lever *c* and the needle *g* will always be parallel. It was found, however, that this was not always exactly the case in practice; variations of the voltage caused

sometimes considerable errors in the readings. To make the apparatus independent of variations of voltage, the arrangement shown in the second diagram is now used. While in the older resistance coil, parts of equal length had equal resistance, this is not any more the case in the resistance coil used in the new instruments; here the

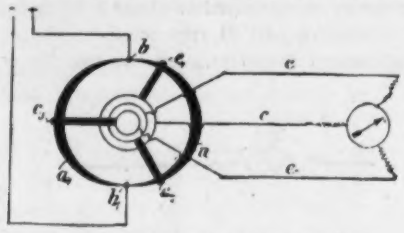


FIG. 2.—SYSTEM OF DIAL SIGNALS.

resistance of the single parts of the coil varies according to a certain law, indicated by the different thickness of the lines in the diagram. Besides, the direct current is now supplied to the coil at two fixed opposite points *b* and *b*. The current is taken off from the resistance coil and supplied to the three line wires, at three points, which can be varied, but always differ by 120 degs. This is accomplished by means of the three brushes $c_1c_2c_3$.—*Elek. Zeit.*, July 19.

Faults on Telephone Circuits.—An anonymous illustrated article describing "some interesting faults on telephone circuits." The presence of electric light mains near telephone circuits frequently causes disturbances in the latter, even although there is no actual contact or leakage between the two circuits. He refers to a case where there was a great noise on all lines of a small telephone exchange; it was found to be due to a fault in an electric light cable; it was remarkable that although the sound was loudest on lines which earthed near the fault in the light main, yet on lines which were earthed three or four miles on the opposite side of the exchange to the fault, there was sufficient noise to render conversation very difficult. Defective or unsuitable material will often cause a great deal of trouble; he describes such a case. On single line systems of telephones, faulty earth wires frequently cause overhearing and partial contact; the reason is that when two or more telephones complete their circuit through one earth wire and any resistance is introduced in it, instead of all the current going to earth through the earth wire, a portion will continue along the wire to the second telephone, etc. Faulty connecting up of the various parts of an instrument will frequently give rise to peculiar faults. In one case a second receiver was connected to an instrument, and there not being any special terminals on the instrument for this purpose, the receiver was connected in shunt with the induction coil secondary instead of in shunt with the first receiver; the effect was that messages could be received all right, but could only be transmitted very faintly, because the current which should have gone to line shunted through the second receiver. In another case complaint was made of there being a current on a certain telephone line when the instrument was in use; it was found that the primary and secondary circuits were connected in series; the effects were rather curious; while speaking, the current was sometimes strong enough to actuate the ring-off signal, but the speaking properties of the telephone appeared not to be interfered with to any appreciable extent. A very annoying fault is frequently caused by wires breaking under their coverings; this class of fault is so apt to be intermittent, and everything to be in apparently good working order while being examined; in testing for such faults a low battery power should be used, not more than two or three cells, as a higher e. m. f. is liable to break the fault down and leave the circuit good until it is disturbed.—Lond. *Elec. Rev.*, July 27.

Braun's System of Wireless Telegraphy.—A description taken from patent specifications of Braun's system, which was already referred to in the Digest. His first patent relates to the generation of electric oscillations by means of Leyden jars and induction coils, while the receiving station has the usual coherer and a local battery. His second patent relates to the propagation of the electric oscillations along the surface of the earth. The transmitting apparatus is provided with two plates let down into the earth; the receiving apparatus is also provided with two earth plates "intended to be placed at points of the earth of different potential," they are connected by a wire containing the receiving apparatus with coherer and local battery.—*Schweis. Blaetter fuer Elek.*, June 22, July 8.

Wireless Telegraphy.—A brief note stating that wireless telegraph apparatus was sent with the British reinforcements which arrived at Tientsin at the end of last week. During the recent French naval manoeuvres off Cherbourg, communication was maintained between vessels over 40 miles apart by means of wireless telegraphy. The record at the British naval manoeuvres last year was 67 miles. On the other hand, it is said that this year on one occasion communication failed at a distance of 25 miles.—Lond. *Elec.*, July 27.

Batteries for Telephone Exchange Use.—Dinsmore.—A paper read before the Illinois Tel. Ass'n, giving some practical hints. He recommends that every exchange should have a small low-reading voltmeter for tests, and should keep a written record of the behavior of the batteries. In selecting a battery, always one with a low internal resistance and a high recuperative power should be chosen. For ordinary exchange use, the regular type of carbon cylinder battery with a pencil zinc, using "sal ammoniac" or some of the more recent battery salts as an excitant, gives good results, but for a telephone that is to be used almost constantly a carbon battery with a large circular zinc will stand up better and longer and give better results. As to "sal ammoniac," great care should be taken to obtain a good grade of imported chemically pure sal ammoniac; he describes two methods of testing the quality of sal annomiac. The proper amount of sal ammoniac should be used to charge a battery; "from four to six ounces of good, pure and clean sal ammoniac makes the best solution." The zinc should always be well amalgamated; cast zincs should never be used. Some makes of dry batteries are giving good results, but the majority of them cannot stand the heavy work required in telephone exchanges. He describes in detail the use of the Callaud or gravity battery for operating switchboard transmitters, and recommends the use of hydrometers for testing the strength of the solution.—*Tel. Mag.*, July.

Protection of Telegraph and Telephone Wires in Connection with Overhead Traction.—Quin.—A paper read before the British Munic. Elec. Ass'n. He thinks it would be best to place telegraph and telephone wires underground where they cross the lines of tramway routes. Where this is impossible, he suggests the erection of two guard wires 18 ins. apart, at a minimum height of 2 ft. above the trolley line. The length of the guard wires should be such that should the crossing telegraph or telephone wire break close up to one span insulator, and be blown horizontally in either direction, it could not when falling come in contact with an unguarded portion of the line. Each span of guard wires should be separate and distinct from its neighbor, but metallically looped across. No insulators whatever should be used, but guard wire standards be bolted direct to the bracket arms, or the span wire, as the case may be. The terminal posts of each length of guard wire should be bonded to the tram rails. The trolley line should be divided into sections, and each protected by a maximum current device; these sections should preferably not be of equal length, but proportioned for equal maximum working current. The crossing span of telegraph or telephone wires should be terminated by a disconnecting insulating shackle on each side and the connection across these shackles should be by fusible metal bridge.—Lond. *Elec. Eng.*, July 20; *Elty*, July 25.

REFERENCES.

Telephonograph.—Olivier.—A longer, illustrated description of Poulsen's instrument (Digest, June 23, July 7, Aug. 4).—*Revue Gen. des Sc.*, June 30.—A briefer illustrated description by Gueroult, of the same instrument, in *La Nature*, June 23. Another brief, illustrated description in *Elek. Anz.*, June 7. A brief description, without illustrations, in *Zeit. fuer Elek.*, May 27. The editorial of *Elek. Zeit.*, noticed in the Digest June 23, is abstracted at some length in *Eng. Mag.*, August. A brief description, without illustration, in *Phys. Zeit.*, June 23. A long and very well illustrated description, by Blondin, in *L'Eclairage Elec.*, June 16.

Writing and Picture Telegraph.—Some notes on a new writing and picture telegraph, invented by Ritchie. The pen on the receiving instrument moves as fast as an ordinary writer moves the pencil of the sending instrument. No skilled operator is required, and the transmitting pencil is moved by the writer of the message. No further technical information is yet given.—Lond. *Elec., Elec. Eng.*, July 27; the latter journal gives samples of writing and a sketch, as transmitted and reproduced; the reproduction appears quite good.

High-Speed Telegraphy.—Munier.—Continuations of his long illustrated serial on high-speed telegraphy systems (Digest, June 30), dealing with the methods of formation of the signals in electric telegraphy, the alphabets used, and the transmission of the signals.—*L'Eclairage Elec.*, June 2, 9, 23, 30.

Telephony for Railways.—H. W. Pope.—A paper read before the Ass'n of R'y Teleg. Superintendents at Detroit. He points out that

in telephoning there should be the same freedom from local restrictions or boundaries as in the mail or telegraph service; a telephone to be of value, should talk anywhere and everywhere; the system must necessarily be a monopoly. He says that a telephone should be in every country railway station, and the best system should be installed; telephones then would soon prove to be far superior to telegraphy in the manipulation of railway service.—*El'ty*, July 25.

Telephonic Experiment.—An illustrated description of Pierard's telephonic experiment without battery, noticed in the Digest Apr. 28.—*Elek. Anz.*, June 14. This experiment is briefly discussed in a note by Bermbach, who appears to consider the observed effect as due to thermoelectricity, while Pierard denied that.—*Elek. Anz.*, June 24.

Extension of Small Telephone Exchanges.—An article recommending to small exchanges to take up the connection of intercommunicating and interior telephone systems: banks, mills, public institutions and even private residences could all with advantage use several telephones to connect their various departments. Nothing but high grade instruments should, however, be used for interior work. A type of instruments for this purpose of the Holtzer-Cabot make is briefly described and illustrated.—*Tel. Mag.*, July.

New Exchanges.—An article giving some general hints as to the arrangement and equipment of new exchanges. The choice of location, the equipment, the arrangement of the switchboard and the causes to which cross-talk is due, are briefly discussed.—*Tel. Mag.*, July.

Insulation of a Bare, Telegraph Wire Laid on Ice.—An article on the experiments of Lespieau and Caura, who found telegraphy perfectly possible with such wiring on Mont Blanc, as noticed in the Digest Feb. 17.—*Sc. Amer. Sup.*, July 28.

Disinfection of Telephones.—An article advocating to regularly disinfect public telephones or to use a system of automatic disinfection; such a system, patented by Taylor, is described and the arrangement illustrated.—*Elek. Anz.*, June 28.

Statistics.—Statistical articles on telegraphy and telephony in Italy, 1897-8; on telegraphy in Japan, and on telegraphy and telephony in Russia in 1898.—*Jour. Tel.*, June 25.

France.—D. B.—A statistical article on the mail, telegraph and telephone service in France.—*La Nature*, June 2.

MISCELLANEOUS.

Manufacturing Glass Electrically.—BERMBACH.—An illustrated article giving some information about trials made by a German company with a method of Becker of manufacturing glass by means of the electric arc. The raw material is fused by an electric arc; to clear and purify the fused mass of glass, it is run down a stairway, the single steps of the stairway being acted upon by other electric arcs; the operation of the process is continuous. The disadvantages of the old processes of making glass are pointed out, and the form of a Becker electric furnace is given in two diagrams from the patent specifications. He says that it is not necessary to keep automatically the distance of the carbons constant; as they had a diameter of 1.4 in., their consumption was slow, and the arc could have a length of 2 ins., if the fused glass was flowing away directly below the arc. He says that obnoxious influences from electrolysis of fused glass could not be observed.—*Elek. Anz.*, June 17.

REFERENCES.

American Engineers in England.—A reprint of the English article noticed in the Digest Aug. 4.—*Elec. Rev.*, July 25.

Cable Manufacturing Plant.—An article on the works of the St. Helens Cable Co. At the St. Helens plant both copper and steel wire is drawn and stranded, while at the Warrington plant the wire is converted into cable for electrical purposes. The latter plant is described in detail, with numerous illustrations.—Lond. *Elec.*, July 20.

Electric Shocks.—GOGGIA.—An illustrated summary of the facts known about the physiological effects of electric shocks, causing death.—*Cosmos*, June 16 and 23.

Production of High Temperatures.—GOLDSCHMIDT.—A description of various applications of his process of working aluminum with the oxides of other metals (Digest, Sept. 2, 1899) for the production of pure metals free from carbon and for welding purposes.—*Glueckauf*; abstracted at some length in *Eng. Mag.*, August.—A brief, anonymous article on the same process in *Cosmos*, July 21.

Paris Exposition.—SCHOOP.—Some remarks on electro-chemical exhibits and on storage batteries and primary cells at the Exposition.—*Elek. Neu. Anz.*, July 1.

SUPLEE.—An illustrated article on the local transportation at the Exposition.—*Eng. Mag.*, August.

An illustrated series of articles on the Exposition begins in Lond. *Elec.*, July 20.

An illustrated description of direct and three-phase current generators exhibited by Schuckert & Co.—*Elek. Zeit.*, July 12.

LAFFARGUE.—An illustrated description of the electric railway of the third-rail system.—*La Nature*, June 9.

LAFFARGUE.—An illustrated article on the distribution of the electric energy at the Exposition.—*La Nature*, July 7.

PERISSE.—An illustrated description of the different types of inclined traveling stairways, operated electrically.—*La Nature*, July 14.

DE MORSIER.—An illustrated description of the moving platform.—*Revue de l'Elec.*, July 15.

An illustrated article on generating sets in the German section.—Lond. *Elec. Rev.*, July 20.

MONTPELLIER.—An illustrated description of an electrodynamometer balance devised by Lord Kelvin and exhibited by White, Glasgow.—*L'Elec.*, June 30.

LOPPE.—A very well illustrated description of the 2000 kilovolt-ampere three-phase alternator of Siemens & Halske, coupled to a Borsig steam engine.—*L'Elec.*, July 7.

DARY.—A description of an electric automobile, exhibited by the Electrical Power Storage Co.—*L'Elec.*, July 7.

BARBILLON.—A long well illustrated description of a telephonic apparatus of Dardeau, for a telephonic line containing quite a number of stations. It allows to call up any one of these stations and only this; to suppress the call, if the station called up did not answer after a certain time; to get an answer by a bell from the station called up; to call up and communicate with any number of stations at once; to show to all stations whether the line is free or not, and to show also the station that is called up; to interrupt a talk in case that the line is not free and an urgent message is to be transmitted. The operation is very simple by means of two buttons. The arrangement of the apparatus is described in detail and illustrated by many diagrams.—*L'Eclairage Elec.*, May 26.

BLONDIN.—A long illustrated article on the Charon gas motors.—*L'Eclairage Elec.*, June 2.

BLONDIN.—A summary of the electrical exhibits and a long, very well illustrated description of Poulsen's telephonograph.—*L'Eclairage Elec.*, June 16.

New Book.

PRATIQUE INDUSTRIELLE DES COURANTS ALTERNATIFS, COURANTS MONOPHASÉS. By G. Chevrier. Published by Georges Carré and C. Naud, Paris, 1900. Cloth, 268 pp.; 107 illustrations.

This is a treatise on alternating currents and their machinery, written for engineers. It treats the subject from the theoretical side, and according to the French school, algebraically with geometrical illustrations. There are seven chapters, entitled respectively: I.—General principles. II.—Alternating-current circuits. III.—Conditions of operation of a single alternator. IV.—Conditions of operation of several alternators in parallel. V.—Transformers. VI.—Alternating-current motors. VII.—Distribution of alternating currents. The book well illustrates the conditions affecting European as distinguished from American practice.

A curious noun which seems to have been adopted into French technological literature, as here shown, is the word "self," as meaning self-induction. The book will be of considerable interest to the student of alternating currents.

Directory of Electrical Societies, Etc.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct., 16, 17, 18 and 19. 1900.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Next meeting, Saratoga, N. Y., Sept. 4, 1900.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Kingston, Ont., Aug. 29-31, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept., 25, 26 and 27, 1900.

OLD-TIME TELEGRAPHERS' ASSOCIATION AND THE U. S. MILITARY TELEGRAPH CORPS. Next meeting. Minneapolis, Minn., Sept. 18, 1900.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Next meeting, Buffalo, Sept. 18 and 19.

THE ROENTGEN SOCIETY OF THE UNITED STATES. Next meeting, New York City, Dec. 13 and 14, 1900.

An Inexpensive Cooling Tower.

The ingenious structure illustrated on this page was designed by W. W. Titzell, superintendent of the Peoples' Electric Light & Power Company, Jersey City, N. J. The condensing water for the central station at Wayne and Fremont Streets is furnished by two large wells, one of which receives all the waste water from the large Pennsylvania Railroad roundhouse a short distance away, and a shallow pond nearly two acres in surface was formerly depended upon to cool it with sufficient rapidity. This pond was connected to one of the wells by a 12-in pipe, so that the level of the water was always the same in both, the supply for the condenser being taken from the well and discharged about the middle of the pond. Toward the end of last year, however, the growth of the station had rendered this means insufficient for the proper cooling of the condensing water, and it was found impossible to lower the temperature rapidly enough to run the entire plant condensing. It was then that the tower shown was constructed, and its extreme simplicity and efficient action merits a description.

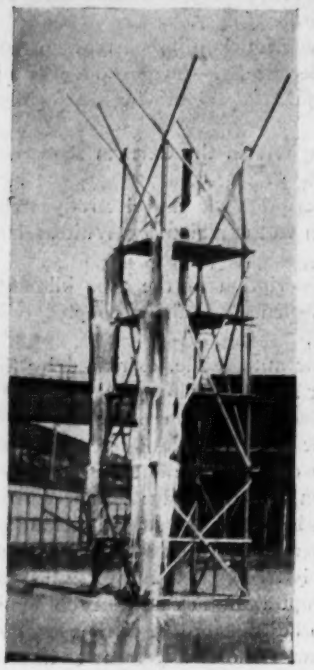


FIG. 1.—TOWER AT REST.

The structure is about 34 ft. high high from the surface of the water to the top platform, the discharge pipe in the centre, as seen from the view of the tower when not running, standing about 6 ft. higher. Four or five platforms made of lattice work are placed within the

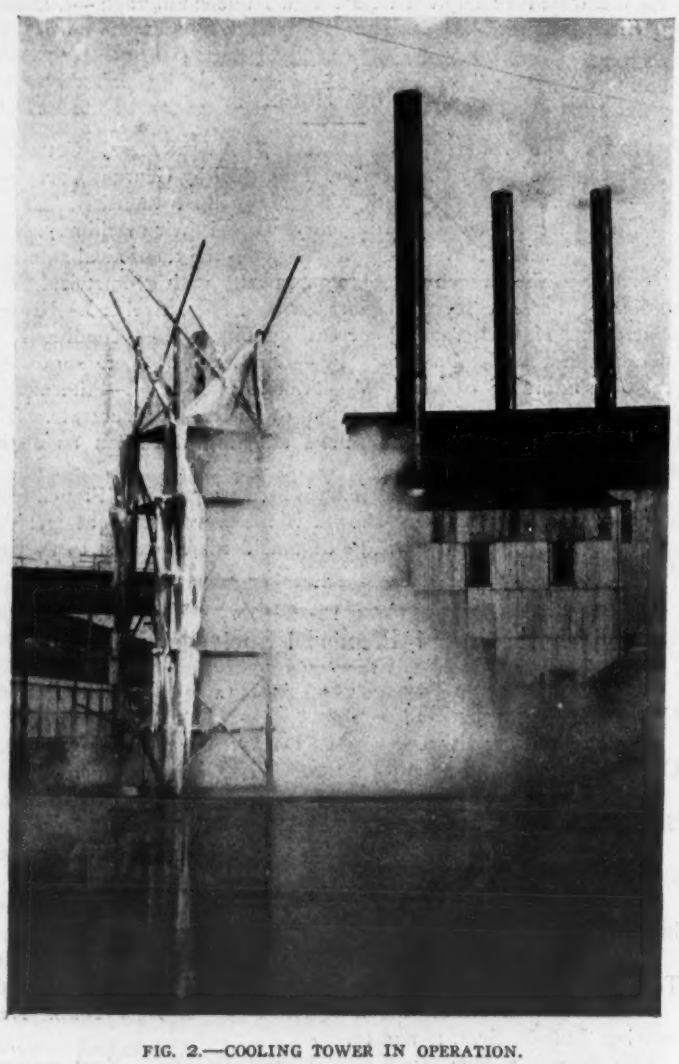


FIG. 2.—COOLING TOWER IN OPERATION.

structure at regular intervals to break up the water and allow of its effectual contact with the air. The photographs from which the accompanying cuts were made were taken last winter shortly after its erection. It has been found advisable during the warm weather to place piles of brush on some of the platforms in order to separate the falling water into smaller streams. The circulating pump which formerly had to force the water out against the back pressure in the pond, now lifts it to the top of the discharge pipe, and it is said very little more pressure is required. About 1500 gallons per minute are discharged, which corresponds to a capacity of something like 1300 horse-power, and in the hottest weather this is cooled from 135 to 94 degs. The working of this tower was so satisfactory that another has since been built near it of the same capacity, and by using both the plant is operated condensing at full load during all seasons. As shown by the illustrations, the construction is very simple, some old joists being used as the greater part of the material, with a central column made of discarded sections of 12-in pipe. Since the photographs were taken the ends of the joists have been trimmed off and the general effect greatly improved.

There are many central stations throughout the country that could be run much more economically had they a means of cooling their condenser water. On the other hand, some are running condensing on water taken from the public mains and paying by meter because their plant is unable to supply the growing demand if operated non-condensing. In such plants, where the surroundings will allow of its erection, a cooling tower of the kind above described might be found of great service.

Considerable annoyance was formerly produced by the "pounding" in the pipes. At times this would be so great as to move the discharge pipe back and forth for some distace at each stroke of the pump. An ingenious remedy for this familiar trouble was found which enables the system to work at present with but slight vibration. Although seemingly "against the books," a petcock was inserted in the suction pipe near the pump, and by allowing the admission of a small quantity of air secured very good results. The trouble was still further alleviated by transferring the suction chamber from the intake side of the pump to the opposite side, these two simple expedients reducing the vibration to a remarkable extent.

An Automatic Control for Printing-Press Motors.

ONE of the most trying, if not absolutely most difficult set of requirements of speed regulation under severe torque conditions which the electric motor is called upon to meet is that imposed upon motors used for the individual driving of large perfecting printing presses. The torque required to start such a press is, as a rule, much greater than that required to run it, in addition to which there are hard spots in the press cycle against which the motor may be called upon to start. On this account a motor working on resistance tends to run up in speed rapidly as soon as the press is started against its heavy friction of rest, requiring with the usual hand controller no little skill and care in manipulating the rheostat to hold the motor down to a low speed. The attention of the pressman must be given to so many details in the process of threading the paper, making ready, and accelerating up to speed, that the motor should, if possible, be controlled by apparatus which will automatically hold the press at any desired speed, high or low, or accelerate it smoothly and uniformly up to any desired speed with the least possible attention from the pressman. The problem is essentially one to be solved in the design of the controller and its proper solution makes the electric motor immensely superior to all mechanical means of driving large, multiple-decked rotary presses.

To give definite speed control at extremely low as well as high speeds, and to give automatic movement of the controller at the proper rate from one position to another in response to a simple touch from the pressman, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has designed what is known as the multiple-solenoid controlling system, one equipment of which is described and illustrated below.

In general, the multiple-solenoid system substitutes for the usual rheostat arm a series of magnets which operate successively, cutting in or out resistance, these magnets being excited by the back e. m. f. of the motor and being so connected that they operate successively with a proper time interval between steps to give a smooth acceleration to the speed. They are also connected to stations scattered about the press by which their movements can be started or stopped by the simplest of manual operations.

In order to facilitate shipping, alterations and adjustments, the larger sizes of these multiple-solenoid controllers are made up in 15 sections, as shown in the accompanying illustration, Fig. 2. The ap-

paratus in each of these sections is mounted on a piece of marbleized slate 18 ins. high and 16 ins. wide, to the rear of which is also fastened the appropriate resistance. All the connections are made on the front of the assembled sections by means of polished copper bars. By removing one screw from one end of any of these bars it can be swung around to clear one of the sections to which it is attached, and in this way any one of the sections may be readily cleared of entanglements with other sections, so that it may be pulled out of the framework.

Before taking up a description of the circuits of the solenoid system itself, it may be well to explain the method of obtaining very slow speeds (such as 5 per cent. of normal) used both in this system and others developed by the Cutler-Hammer Manufacturing Company. The low speeds are obtained without independent sources of low-voltage current, such as motor-driven teasers, but by shunting the motor armature with a resistance connected directly across the brushes, the armature in shunt with this resistance remaining in series with the usual starting rheostat across the line. A simple diagram of the connections is shown in Fig. 1. It will be readily seen that this, in a sense, places the armature across a more or less constant potential, consisting of the drop in the armature and its shunt resistance, which, in series with the drop in the starting box or controlling resistance, makes up the total potential difference of the line. The action is somewhat the same as though the two resistances were two sections of a storage battery, dividing the line voltage into two sections. Of course, this system wastes current when the motor is operating at very low speeds, but as this lasts only a short time, the actual consumption of current is probably no greater than that with a "teaser" method of control.

It is obvious that if the resistance in shunt with the armature is, for example, .05 ohm, the controlling or starting resistance amounting to .95 ohm, the motor cannot possibly run up to 5 per cent of full speed unless its load is zero, as at 5 per cent of full speed its counter

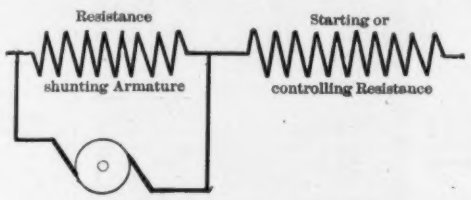


FIG. 1.—CONNECTION FOR SLOW SPEED.

e. m. f. would equal 5 per cent of the full line e. m. f., and would, therefore, be as great as the drop in the resistance in shunt with it, so that at that speed the motor would get no current. In fact, the only way to make the motor exceed this speed would be to apply power to it and drive it as a generator delivering current to the shunt resistance. On the other hand, if the motor tends to slow down materially below the speed where its counter e. m. f. equals the drop in the shunt, it gets practically all of the current coming through the controlling resistance, the resistance of the motor armature being less than that of the shunt across its brushes. The motor, therefore, is held against slowing down with almost as great a torque as though the shunt were not in place, but its acceleration is quickly checked by the rising counter e. m. f. throwing the current off from the armature into the shunt resistance.

In the solenoid system here described the resistance forming the shunt is automatically thrown in or out by means of solenoids, in turn controlled by relays sensitive to the motor speed. The motor is started in the usual way with its shunt field straight across the line and its series field and armature in series with the starting or controlling resistance, no shunt resistance being connected in until the motor has started so that the motor gets all the current from the line when starting. As soon as the speed of the armature rises to the proper point the shunt resistance is automatically connected across the armature brushes by means of what is termed a "slow-speed motor governor." In the accompanying illustration of a 40-hp printing press controller, involving these principles, this slow-speed motor governor is shown in the three uppermost sections, Nos. 13, 14 and 15. The connections of the apparatus on these sections are shown in the general diagram of circuits, Fig. 3. Section 15, to the right, contains three solenoids, the coils of which are connected in parallel with each other across the armature terminals of the motor so as to be excited in proportion to the difference of potential between the brushes. These three solenoids are termed "wall controllers." Each wall controller acts simply as a relay, its contacts closing a circuit through the winding of one of the three larger solenoids on sections 13 and 14. The plunger of the left-hand solenoid, on section 13, termed in the drawing a "low-limit solenoid," closes the shunt circuit around the motor armature when pulled up. The solenoid on section 14 (which is the motor governor proper) operates a hinged arm or lever which cuts in or out sections of the resistance thrown in shunt with the armature by means of the low-limit solenoid.

When the motor starts and runs up to nearly the speed at which the governor is supposed to limit it, the left-hand wall controller on

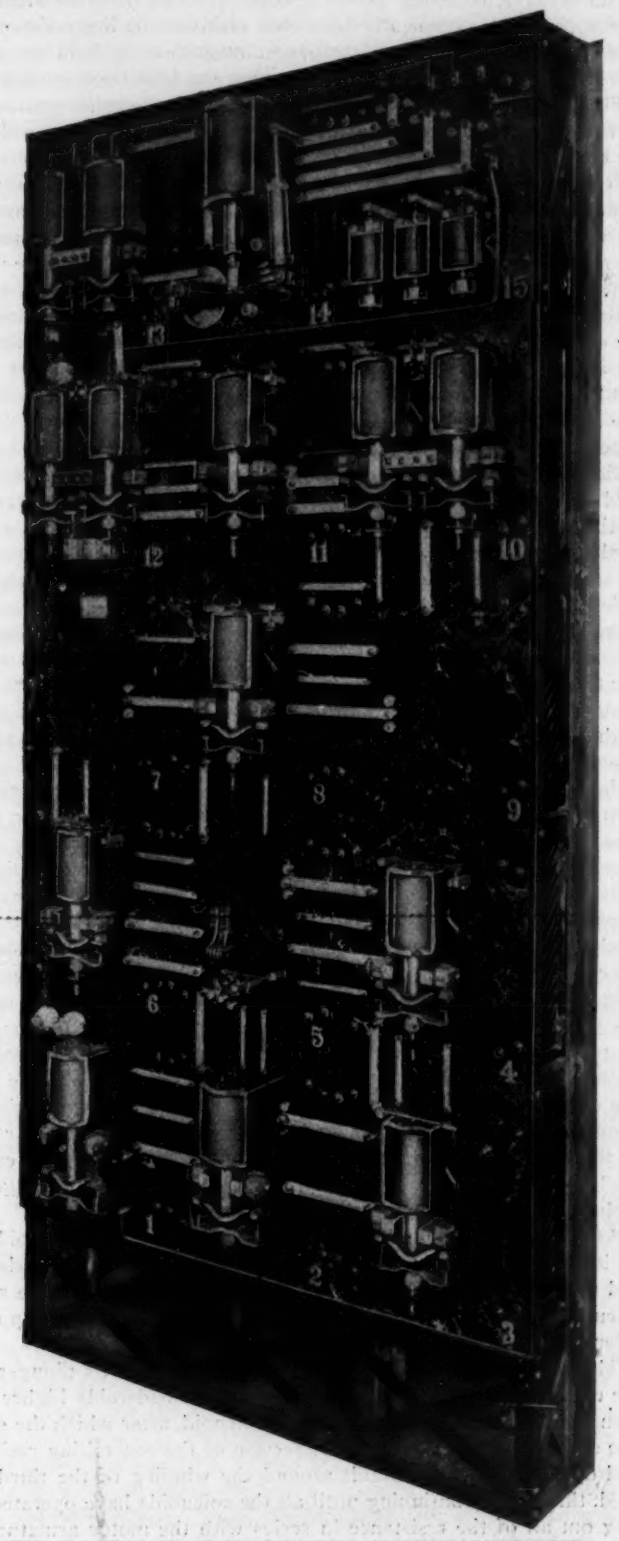


FIG. 2.—VIEW OF 40-HP MULTIPLE SOLENOID CONTROLLER.

section 15 operates, bringing up the left-hand plunger on section 13 and closing the shunt around the armature. The resistance of this shunt is made such that normally it will not entirely check the rise of speed of the motor, which will continue slowly to speed up until the middle wall controller is sufficiently excited to pull up its armature, which will excite the coil of the slow-speed governor solenoid on section 14. The plunger of this solenoid will then begin to rise—being retarded by the dash pot—and will rotate its contact arm over several segments, gradually cutting out sections of the shunt around

the motor armature and reducing the resistance of this shunt until the armature of the motor ceases to accelerate any further and again slows down. The counter e. m. f. of the armature then falls, the middle wall controller lets go, the plunger of the motor governor solenoid begins to fall by gravity—being retarded by the dash pot—and the resistance in shunt with the armature is gradually increased step by step until the armature again accelerates, pulling up the middle wall controller and causing the slow-speed governor solenoid to pull up its plunger, reducing the resistance in shunt with the armature. The apparatus consequently see-saws, maintaining the resistance in shunt with the armature at the proper magnitude to hold the armature at the desired speed, no matter what the load upon it may be.

The purpose of the right and left-hand wall controllers on section 15 with the two solenoids on section 13, is to anticipate the action of the comparatively sluggish governor on section 14 in case of a sudden change of load upon motor. For example, if the press should run into a very hard part of its cycle, the governor proper might not increase the resistance across the armature terminals fast enough to prevent the motor from stopping. The left-hand controller in this case would act ahead of the governor, dropping its contact, which would open the circuit of the left-hand solenoid (termed a "low-limit solenoid"), the plunger of which would entirely open the shunt around the motor armature and prevent the motor from stopping. On the other hand, in case the motor load falls off greatly and the speed tends to rise too rapidly to be checked by the slow-acting governor solenoid, impeded by its dash pot, the wall controller to the right would become sufficiently excited to close its contact, causing the right-hand solenoid on section 13 to pull up its plunger, short-circuiting a large part of the resistance in shunt with the armature and thus checking any further rise of speed. Thus the right and left-hand wall controllers on section 15 and the two solenoids on section 13 are what might be called "high and low limits," which anticipate the action of the more sluggish and more exact governor proper. The motor is thus held automatically down to speeds suitable for "making ready," no matter what the load may be or how it may change from instant to instant, enough current being taken from it by the shunt to reduce its torque to that required by the load. It is not robbed of any current until it attempts to run too fast.

For obtaining higher speeds, this slow-speed motor governor is thrown out of action, removing the shunt around the motor armature, leaving the armature in series with the usual controlling resistance. Instead of connecting the various steps of this controlling resistance to the segments of a manually-operated contact arm, the steps are connected to the contacts of the seven solenoids shown on sections 3, 4, 6, 8, 10 and 11. The windings of these seven solenoids are connected in series with each other and with two others described below across the armature of the motor. When the motor is started, the windings of all these seven solenoids, except the first one, are short-circuited by means of carbon contacts above the solenoid frames. The contact above the first solenoid short-circuits the winding of the second, the contact on that solenoid short-circuits the winding of the third one, and so on through the series, the contact on the last one short-circuiting a lamp intended to reduce the current used by the solenoids to a strength sufficient to hold their plungers up without wasting the current necessary to pull them up.

As the motor speed and counter e. m. f. rises, the first solenoid pulls up its plunger, cutting out one section of the controlling resistance, and also opening the short circuit around the winding of the second solenoid, thus increasing the resistance in the circuit made up of the solenoid windings.

The second solenoid, therefore, does not pull up its plunger until the counter e. m. f. of the motor reaches a considerably higher value than that required to operate the first solenoid, after which the second one operates, cutting out another section of the controlling resistance and opening the short circuit around the winding of the third solenoid, this action continuing until all the solenoids have operated, cutting out all of the resistance in series with the motor armature and connecting the latter straight across the line. It will be noted that on section 12 there are two more solenoids, the windings of which are connected in series with those of the seven solenoids just described, the plungers being so connected as to cut out the series field coils of the compound-wound motor in two steps, one step to each of the two solenoids. When all the accelerating solenoids on sections 3, 4, 5, 6, 8, 10 and 11 have pulled up their plungers and thereby cut out all of the resistance, the motor is working as a compound machine without controlling resistance in series with it. When the solenoids on section 12 have pulled up their plungers the motor is working as a plain shunt machine directly across the line.

There will be noted on the lower part of the board in sections 1 and 2, two other solenoids, one of which (termed the main solenoid) is for throwing the motor and all the other apparatus in circuit when starting, or out of circuit when stopping. This switch is supplied with two powerful blow-out magnets located in the back of the slate, the purpose of these magnets being to disrupt the arc formed when a press is started and then quickly stopped. The sparking is taken on heavy carbon breaks to further protect the multiple copper leaf contacts. The winding of this solenoid is connected in series with two incandescent lamps across the line. These lamps have sufficient resistance to keep the solenoid from lifting, but will allow sufficient current to pass to hold the plunger up after the solenoid has once lifted it. The solenoid is made to lift its plunger by short-circuiting the two lamps, thus connecting the solenoid winding directly across the lines. This connection can be made at any one of a number of starting and stop-

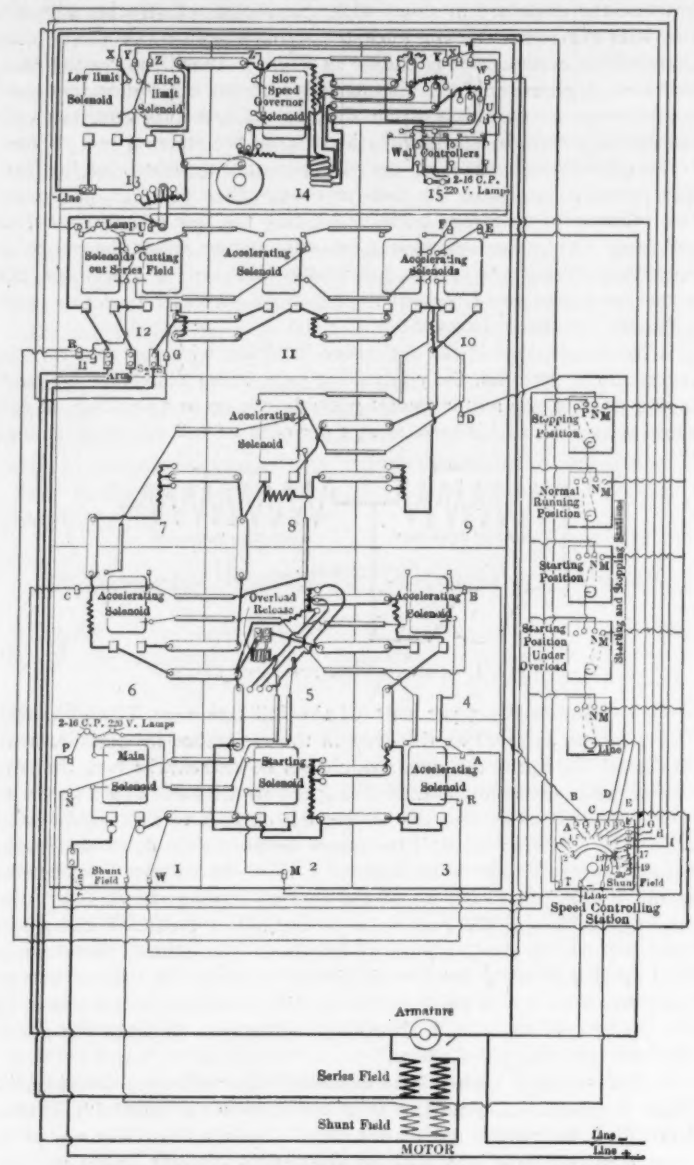


FIG. 3.—DIAGRAM OF CIRCUITS OF 40-HP CONTROLLER.

ping stations—as many as may be desired scattered around the press. A view of one such station is shown in Fig. 4. Its size is 3 in. x 4 in. It controls the largest size of presses. Five of these starting and stopping stations are indicated in the right-hand side of the diagram of connections, Fig. 3. Normally the handles of all these stations are held by springs in such a position as to make a circuit through the main solenoid in series with the two lamps. By moving the handle of any one of these starting and stopping stations from its normal position one point to the right the lamps are short-circuited, pulling up the starting solenoid, closing the main circuit from the line to the motor, after which the automatic devices take charge of the control, accelerating the speed smoothly and at a predetermined rate up to any desired value. The handle of the starting and stopping device is moved back by a spring as soon as released, resting normally on a contact which leaves the winding of the main solenoid in series with the two lamps, holding the plunger of this solenoid in

the closed position. By moving the handle of any starting and stopping station to the left, the circuit through the main solenoid is broken, cutting off current from the motor, and all the other solenoids, stopping the motor and allowing the automatic solenoids to resume their normal positions.

There is provided for the starting and stopping lever a fourth position to the extreme right, which position operates the solenoid shown on section 2. The plunger of this starting solenoid short circuits some of the controlling resistance and thereby provides a means of positively starting the motor in case its load is so great that it will not start with the usual controlling resistances in series with it.

There is, in addition, what is termed a "speed-controlling station," indicated in the diagram, Fig. 3. The position of the lever at this station determines the speed to which the automatic solenoids will bring the motor when started at any of the starting stations. By placing the lever of the speed-controlling station on the extreme left-hand button, the slow-speed governor mentioned above will throw in its shunts around the armature and automatically compel the armature to stay down at the lowest specified speed when started at any of the starting stations. With the lever on any one of the next several buttons the motor will be able to run up to a little higher speed, due to the resistance inserted in series with the wall controllers of the slow-speed governor. If the lever of the speed-controlling station is set over still further to the right the motor governor does not come into action at all, no shunts being connected across the armature terminals of the motor. The several further positions of the speed-controlling lever cut out respectively

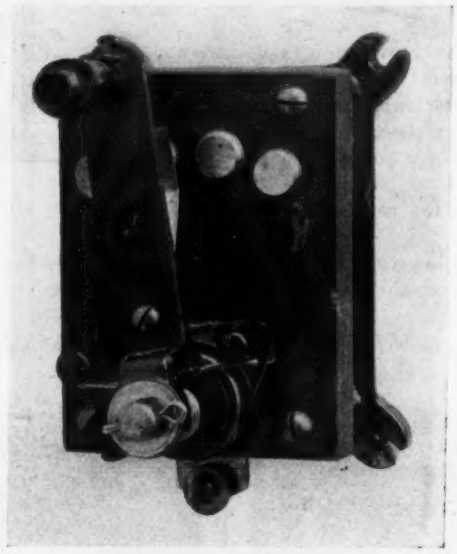


FIG. 4.—VIEW OF THE STARTING AND STOPPING STATIONS.

the seven accelerating and the two field solenoids, thus stopping the action of these multiple solenoids at a motor speed determined by the position of the speed-controlling lever. The speed-controlling lever can be left permanently at any position, either on the contacts bringing into action the slow speed governor, or on those bringing in the multiple-solenoid regulator, and the starting can be accomplished from any of the starting stations by one quick movement of any of the starting levers, the automatic apparatus then taking hold and bringing the motor up to the speed determined by the position of the speed-controlling lever. Even if the speed-controlling lever is suddenly moved up from a low-speed to a high-speed position the motor is not suddenly speeded up, since the solenoids gradually accelerate the speed in any case. Care should be taken, however, not to move the speed-controlling lever suddenly from a high speed to a low speed governor position when the motor is running, or the shunt will be connected around the armature, checking the speed so rapidly as to endanger the press. The speed-controlling station is also provided with a resistance for insertion in series with the shunt field of the motor for the purpose of obtaining the highest speeds.

On section 5 there will be noted a magnet of the type generally used for overload release. In case of an overload the armature of this magnet opens the starting and stopping station circuit to the winding of the main solenoid, dropping the plunger of the latter and cutting off current from the motor and from all the other solenoids. This overload release is so connected that it is out of circuit when the overload starting rheostat is closed as well as when the first two accelerating solenoides are open, only coming into action after the second accelerating solenoid has operated to cut out the second section of resistance. Thus the overload release can be adjusted to protect the motor against overheating from a continued overload, without danger of its operating under the invariable brief overload of starting.

It will be noted that some of the bars between different sections are arranged so that they can be swung around and screwed to any one of the several buttons. For instance, the upper end of the heavy bar between sections 2 and 5 can be connected to any one of four buttons, thus varying the amount of resistance cut out by the starting solenoid. This arrangement enables the purchaser of the controller to regulate the resistance to suit the requirements of the motor and press. This is necessary on account of the fact that different presses require different currents to start them or to bring them up to the proper speed for threading the paper. By means of these adjustments the controller can be set to admit suitable currents for the different required speeds when the press is new and stiff and the adjustment can be changed when the press becomes limbered up, so that less current is required.

With the original starting current, the action of the seven accelerating solenoids cutting out the resistance and of the two solenoids cutting out the series windings, the motor is brought up to speed in ten steps, apparently a small number for a 40-hp machine. On account of the facts that these steps take place automatically at the right time and that there is no chance for arcing when the controller advances, as there is with a sliding contact, the number of steps can be greatly reduced. As a matter of fact, the motor is brought up to speed smoothly and rapidly if the solenoids are allowed to work automatically. It can be speeded up as slowly as desired, however, by checking the automatic devices by means of the speed-controlling station.

The first equipment of this kind was recently put into service for the *Kansas City Times*. The press is a Goss straight-line perfecting with three decks and color attachment. It is driven by a Lundell 30-hp motor with 40 per cent compounding. The controller is the one illustrated above, and is rated at 158 amperes at 230 volts. Tests made on this press give interesting data on the relative starting and running torques. The current required for starting the press with only two decks in operation is about 120 amperes; the current required from the line to operate the press at a very low speed, with the armature shunted by the motor-governor device described above, is about 70 amperes; with the shunt thrown out and all the starting or controlling resistance in series with the armature, the current falls to 40 amperes, the counter e. m. f. of the motor rising to about half the line e .m. f. It is interesting to note that with the same amount of resistance in series with the armature, as in the last case, the motor being at standstill, the current is 82 amperes, and the motor does not start until the starting solenoid is actuated, cutting down the controlling resistance to a sufficiently low value to give the necessary 120 amperes of starting current. Instrument readings of current, counter e. m. f. and speed show very smooth and regular acceleration on the various accelerating points with any number of decks in operation.

A Novel Mechanical Draft Fan.

A duplex mechanical draft fan of peculiar design, and of large size, has recently been built by the B. F. Sturtevant Company, Boston, Mass., for the Oakland Transit Company, Oakland, Cal. The structure, which is illustrated herewith, actually consists of two fans, the upper one having a bottom horizontal discharge, and the bottom one a top horizontal discharge, brought together midway of the height of the fans. Upon the left-hand side is provided a common supply chamber, with dampers so arranged that the gases may be turned to each fan from the boiler flue, and that the volumes admitted to each fan may be regulated by operating the dampers. Each fan wheel is 8 ft. in diameter, in a casing 4 ft. wide. The entire height of the apparatus is 24 ft. Attached to the shaft of each fan is a connected 6 x 9 upright engine, provided with water-capped journal boxes to keep the bearings cool. Each shaft extends through both the fan wheel and the inlet casings, and is supported at the outer end in another capped journal box.

The fans were designed for use on the induced principle—that is, the gases are drawn through the fan, and thence discharged into the

chimney. As a rule, a duplex apparatus of this character is arranged with the two fans on a level with a common inlet connection and coupled shaft, but the conditions existing in this particular plant necessitated the arrangement shown.

DUPLEX DRAFT FAN.

Crest Indestructible Sparking Plugs.

The Crest Manufacturing Company, of Cambridgeport, Mass., manufacturers of Crest motors for automobiles, are putting on the market a radically new design of sparking plug that is not affected by heat and expansion and is consequently claimed to be indestructible.

PLUG.

After a considerable expense in experimenting with the best porcelain, they have discovered a new material that is unbreakable by heat or expansion. They have had these sparking plugs in use for a long time on their motors without any reports of failures, and have decided to introduce them to other manufacturers and users of other makes of motors.

The material used in this plug is a perfect elecerical non-conductor, and does not expand under intense heat. It is a soft, tough material, not being brittle like porcelain.

The sparking plug, as shown in the cut, consists of a shell of steel having a thread at one end to screw in the orifice of the chamber of the motor.

The sparking plug proper consists of a slight cone of this new material, which is inserted in the steel plug. This cone fits tight in the shell, making a gas-tight joint, without packing, rendering the plug proof against carelessness in the hands of unskilled persons. Through this cone a wire is passed terminating at the bottom of the plug, with an enlarged head. A platinum wire is inserted in the body of the steel shell, the spark jumping across between the two points.

Long's Automatic Lamp Support.

The arc-lamp support, illustrated herewith, while permitting a wide range of design, possesses the important advantages of being a time and labor saver; hence is economical to maintain, and affords perfect safety to the trimmer. The lamp is raised to and lowered from its support by means of a ratchet and sprocket chain, shown in Fig. 1, and in the act of lowering, the lamp is automatically cut out of circuit, thus removing all danger to the trimmer from shock. The work of trimming and adjusting the lamp is all done on the ground, it not being necessary for the trimmer to carry a ladder, since the lamp is readily lowered to the workman's level. When the work of retrimming is finished, the lamp is raised to its place and is cut into circuit automatically. The lamp imposes no strain upon the sprocket chain by which it is handled, and remains in positive contact with the circuit when in position. All the working parts are housed and perfectly protected from the weather.

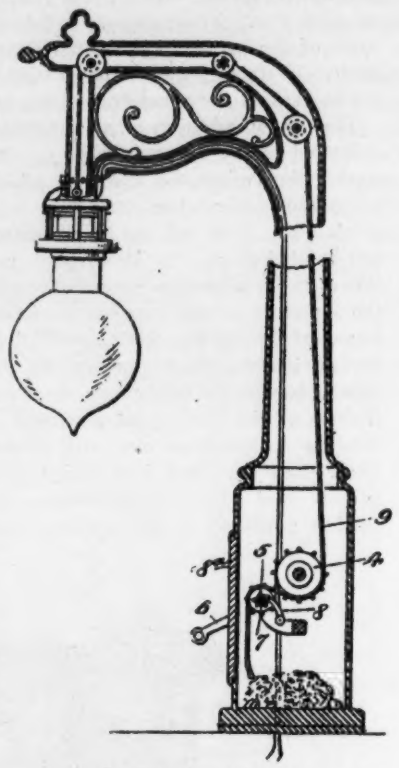
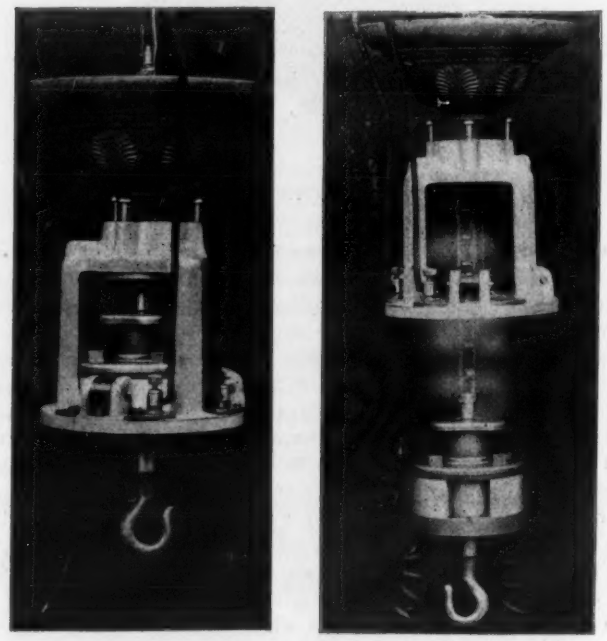


FIG. 1.—LAMP SUPPORT.

As shown in Fig. 1, the raising and lowering mechanism is all contained within the interior of the pole, or support, and is entirely hidden from view. This construction permits of artistic finish, not disfigured by exterior mechanism, and renders these supports particularly adaptable for interior lighting, as well as street lighting. Figs. 2 and 3 show the lamp hanger in position, and being lowered, respectively.



FIGS. 2 AND 3.—LAMP SUPPORT.

This hanger is manufactured by Mr. Harry Long, Greentown, Ind., who is also the inventor of the device. It is constructed of the best materials, heavy sheet mica and fibre being used for the insulation of the parts.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—To the hot weather, the vacation season, the Chinese situation and the approaching presidential campaign is attributed the exceeding dullness in the stock market. Little business, comparatively speaking, was transacted last week, leading speculators apparently waiting for something to turn up or happen. The success of the American subscription for the new British exchequer bonds was the feature in the financial world, and indicates that considerable gold may have to be sent from New York to London. This, it is thought, will lead to stiffer rates for money, although last week the market was quiet, being due largely to the inactivity of the stock market. Time money was in fair demand, but the rates were practically unchanged from those last recorded, being 3@3½ per cent for short, 3½@4 per cent for four months' arrangements and 4@4½ per cent for six months. Commercial paper is quoted at 4@4¾ per cent for prime double names, the market being quiet. Electric securities, in common with the general stock market, were quiet, with a downward tendency in prices, Brooklyn Rapid Transit being the single exception, this stock closing with a net gain of ¼ point. General Electric remains unchanged and Metropolitan Street Railway closed the week with a net loss of 3½ points. The market for outside securities, generally speaking, was firm as to prices, while the amount of business was even smaller than during recent weeks. There is no public interest in the market, and selling orders were quite as few as the buying orders. None of the electrical shares attained any prominence whatever. The Boston stock market closed very quiet, and the Philadelphia market was lifeless. Following are the closing quotations at New York, Boston and Philadelphia, with those of the week previous, for comparison:

NEW YORK.

	Aug. 4.	Aug. 11.		Aug. 4.	Aug. 11.
Gen. Elec.	132	132	Elec. Veh.	18	19
Bklyn. Rap. Tran.	57½	57¾	Elec. Veh., pfd.	40	40
Met. St. Ry.	156¼	152¾	Gen. Car.	5½	4¾
Am. Tel. & C.	90	90	Ill. Elec. Veh. Tran.	1⅝	1½
West. Un. Tel.	79¾	79½	N. Y. Elec. Veh. Tran.	7½	7½
Am. Dist. Tel.	25	25	New Eng. Elec. Tran.	4	4
Com. Cable	160	160	Tel., Tel. & C. of Am.	4½	6
Elec. Boat	15	14	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	30	30	N. Y. & N. J. Tel.	160	160

BOSTON.

	Aug. 4.	Aug. 11.		Aug. 4.	Aug. 11.
New Eng. Tel.	123½	123½	Erie Tel.	..	96
Mex. Tel.	2	2 1-16	Gen. Elec., pfd.	138⅞	138⅞
Westingh. Elec.	45	..	Am. Tel. & Teleg.	143½	142½
Westingh. Elec., pfd.	64	62½	Edison Elec. Lt.	..	205

PHILADELPHIA.

	Aug. 4.	Aug. 11.		Aug. 4.	Aug. 11.
Elec. Stor. Bat.	70	70	Phil. Elec.	2⅜	2⅝
Elec. Stor. Bat., pfd.	75	90	Pa. Elec. Veh.	3½	3½
Elec. Co. of Am.	9	..	Pa. Elec. Veh., pfd.	2	2
Gen. Elec. Auto.	¼	..	Am. Rys.	..	32

FUTURE OF ELECTRICITY.—A correspondent of the Boston News Bureau in Munich, Bavaria, says, in regard to a recent pessimistic interview with Mr. J. R. Keene: "I send you copies of paper published here, showing how the Keene interview looked in print on this side. If the railroads in America have, as he says, only 35 per cent of water in their stocks, they are not getting their full share. The globe is two-thirds water and one-third land. The human body is mostly water, with a little carbon thrown in. Mr. Keene is not an authority here. I see that the betting is 4 to 1 against Bryan's election. When it gets to be 16 to 1 the figures will be more logical. We are all disgusted with the way in which some of the rich men identified with some industrials have been lying about their properties. Some of this lying is monumental. One would think the people were rich enough to tell the truth. I have been impressed with the great future of your local gas and electric light securities. Over here gas is little used. Everything is electricity. Germany is a great country, in spite of the Berlin panic, but she will have to depend on America, as will many other countries. In fact, the rest of the world must knock at Uncle Sam's door for almost everything that goes for material success, including money."

BROOKLYN RAPID TRANSIT.—The market for Brooklyn Rapid Transit stock is much wider than many people in Wall Street suppose. There is more or less trading in it as far west as Victoria, in British Columbia, and as far east as Quebec. It is a fact that one brokerage house in a far-off city in British Columbia was short of the stock on a recent break from 70 as much as 3000 shares. A year or more ago there had been a great deal of Brooklyn Rapid Transit stock bought north of the United States boundary, but this summer a great deal of it has come back.

THE UNION TRACTION COMPANY, Philadelphia, has refunded $200,000 7 per cent bonds of the Empire line, maturing, into 3½ per cents. Fixed charges of $14,000 are thereby cut down to $7000. In other ways the Union Traction Company has been gradually reducing its charges. Several of the old land mortgages have been paid off. The company has in some instances invested the money of its insurance fund, which amounts to about $600,000, in these mortgages at a reduced rate of interest, paying off the original holders. Another step has been the purchase of the Lehigh Valley line, the entire capital, $600,000, having been bought in by the Union Traction Company, which now has a clear profit on this line over all operating expenses.

STATE OF WASHINGTON.—It is reported that a deal has been effected by which the Washington Water Power Company, of Spokane, is to buy the property of the Amsterdamsch Trustees Kantnor in Spokane for $3,000,000. The first payment will be made on the option on or about Sept. 1. To provide for this purchase the capital of the Washington Water Power Company will be increased by $500,000 to $2,000,000. The Tacoma-Seattle Railway has made a mortgage to the Fidelity Trust Company of Tacoma as trustee to secure $1,000,000 of $1000 5 per cent bonds. The mortgage covers the line under construction from Seattle to Tacoma—33 miles—its franchises, rolling stock, etc.

MANCHESTER, N. H.—The Manchester Electric Company has just purchased the Merrimac Electric Light, Heat & Power Company, the Union Electric Company, and the Consolidated Electric Company. Messrs. Tucker, Anthony & Co. will combine all of these interests with their present properties, which consist of the Manchester Electric Light Company, the Manchester Street Railway Company, the Ben Franklin Electric Company, and the Garvins Falls Power Company. The parent company now controls all the lighting, power and street railway interests of that section, including water power of 10,000 to 15,000 horse-power.

NEW YORK TELEPHONE.—The stockholders of the New York Telephone Company last week, at a special meeting, voted to authorize an increase in the capital stock from $16,000,000 to $30,000,000. Of the 160,000 shares, all except 30 were represented at the meeting, and were voted in favor of the increase. After the meeting officers of the company declined to say anything as to the reason for the increase. The action is taken to indicate preparation for a large prospective increase of business.

AMERICAN TELEPHONE.—The directors of the American Telephone & Telegraph Company (Bell) have sold to Kidder, Peabody & Company, of Boston, $10,000,000 4 per cent bonds, price said to be below 96.

YORK (PA.) TRACTION.—The York (Pa.) Traction Company has given a mortgage to secure an issue of bonds for $1,500,000 to the Real Estate Trust Company, of Philadelphia.

DIVIDENDS.—Directors of Metropolitan West Side Elevated have declared a dividend of 2 per cent on the preferred stock, payable Aug. 31.

CHICAGO.—The Chicago City Railway Company has declared a regular quarterly dividend of 3 per cent, payable Sept. 29.

MADISON, WIS.—The Madison Gas & Electric Company is to vote, Aug. 22, on issuing $100,000 of debenture scrip.

Commercial Intelligence.

THE WEEK IN TRADE.—This being the transition period between midsummer and early fall trade, many of the irregularities incident thereto were exhibited in trade conditions last week. There is, however, a more cheerful feeling in general trade, and the bookings of fall orders for hardware, dry goods, etc., at leading Western centres, and heavy engagements in iron and steel products, though at low prices, are of encouraging proportions. Pittsburg and Chicago report a large business in steel products, Western manufacturers of steel bars having disposed of their output up to the close of the year. Despite the hot weather, Bradstreet's reports there is a larger fall trade distribution at Chicago and St. Louis. There is a better feeling there in iron and steel and more animation in hardware. The business failures, as reported by Bradstreet's, were 172 for the week, against 170 the week previous. Copper at New York is practically unchanged in price. Spot business was light, owing to scarcity of soft copper, while in futures consumers do not seem to be willing to engage. Lake, spot, is quoted at 16½c., and electrolytic varies from 16⅜c. to 16½c.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended August 11: Argentine Republic—220 packages electrical material, $11,099; 69 cases electrical machinery, $3931; 18 packages motors, $893; 2 crates automobiles, $737. Antwerp—4 cases electrical machinery, $986; 50 packages electrical material, $4895. Bremen—1 package electrical material, $11. British Australia—6 cases electrical machinery, $1063; 101 cases electrical material, $4412. Bordeaux—6 cases electrical material, $150. British West Indies—14 cases electrical material, $213. All other British possessions—88 packages electrical supplies, $4066. Brazil—20 cases electrical material, $828. Bristol—37 cases electric machinery, $7000; 18 reels elec-

tric cables, $2438. British Guiana—4 cases electrical material, $145. Budapest—1 case electrical material, $41. Cuba—36 packages electrical material, $737. Central America—2 cases electrical material, $55. Chili—104 packages electrical material, $2493. Ecuador—6 packages electrical material, $252. Gothenburg—2 boxes electros, $120. Glasgow—81 cases electrical material, $39,415; 81 reels cable, $33,393; 2 packages trolley poles, $130. Hamburg—41 packages electrical material, $15,676; 1 case electros, $50. Havre—107 packages electrical material, $16,720; 128 packages electrical machinery, $12,865. Hull—6 packages electrical material, $602. London—207 packages electrical machinery, $28,161; 432 packages electrical material, $18,919; 10 packages automobiles, $1500; 27 packages motors, $1041; 283 trolley poles, $12,222; 30 packages electrical machinery, $3800; 17 cases electrical material, $766. Liverpool—3 boxes motors, $555. Leeds—8 packages electrical material, $166. Mexico—25 packages electrical material, $2667. Manchester—4 boxes electrical machinery, $5165. Madrid—12 cases electrical machinery, $1618; 216 trolley poles, $8000. Porto Rico—4 packages electrical machinery, $250; 832 packages electrical material, $1403. Peru—49 cases electrical material, $2810. Southampton—13 cases electrical machinery; 1063; 4 cases electrical material, $67. St. Petersburg—4 cases electrical material, $2019. San Domingo—4 boxes electrical material, $52. Uruguay—8 packages electrical machinery, $920. U. S. Colombia—7 packages electrical material, $275; 8 packages electrical machinery, $700; 10 cases electrical material, $258. Venezuela—3 cases electrical material, $76.

THE TELEPHONE BUSINESS.—C. F. Cutler, president of the New York Telephone Company, is quoted by the *Wall Street Journal* as follows: "There has been a systematic reduction of telephone rates. In 1890 in the City of New York we had about 5,000 subscribers, and now, ten years later, we have about 50,000 subscribers. The use of the telephone is increasing yearly. In 1890 and until a few years ago a telephone cost $240 per year, and at present it costs from $60 per year and upwards. The reduction in prices has been voluntary on our part, and not induced by competition. We find it profitable to reduce rates, as each reduction brings a large influx of new subscribers. In the meantime, the service has greatly improved. All this, remember, with no competitor in the field. The telephone business is not enormously profitable, as many suppose. We are engaged in a constant struggle with the elements. Storms are disastrous, oftimes to our wires and equipments. Switchboards are very costly, and we must constantly put in the latest improvements. These are expensive. I believe that telephones will be lower in the future. The whole tendency of prices is downward. I see, however, no chance at present of any lower prices. The business is on a rock-bottom basis at present."

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has just sold to the Dayton Electric Light & Power Company two 200-kw dynamos, direct connected to cross-compound engines. During the first six months of this year the Triumph Electric Company has done 60 per cent more business than it did during the same period in 1899, and during June and July it doubled the business of the corresponding month a year ago. In its latest bulletin, the company describes direct-connected generators of both engine and marine types. Details of the various parts are given, special attention being called to the brush holders and rigging, and much information is furnished in the text regarding the material and processes of manufacture of these machines.

TO DEVELOP PARAGUAY.—The Paraguay Development Company has been incorporated in Philadelphia, under the New Jersey laws, with an authorized capital stock of $500,000. The objects of the company are to open up and develop the natural resources of South American countries, and especially of the Republic of Paraguay, and to organize and conduct electric and other lighting plants, besides many other purposes. It is stated that the company's applications in Paraguay have been granted. A prominent American capitalist will shortly go to Paraguay to arrange for lighting Asunción, the capital of that country, and to build a trolley line there.

MR. H. WARD LEONARD, president of the Ward Leonard Electric Company, of Bronxville, N. Y., is at present in Europe, where he has recently closed a contract giving Messrs. Geipel & Lange, Westminster, London, the exclusive selling agency for Great Britain and France for Ward Leonard rheostats, circuit breakers and Carpenter enamel rheostats. This firm will carry a large stock of these goods in London and Paris. The Ward Leonard Electric Company is already doing a very large business in Europe, and its comprehensive exhibit in Paris has done much to extend its acquaintance among foreign buyers.

DEMAND FOR ENCLOSED ARCS.—The Manhattan General Construction Company reports that its sales of arc lamps in July—a poor season for such business—exceeded those of any other month in the last seven years. It has closed orders for the Manhattan series alternating current system as follows: Evanston Electric Illuminating Company, Evanston, Ill., 211 lamps; Fairport Electric Company, Fairport, N. Y., 60 lamps; W. M. Sheehan & Co., Wappinger Falls, N. Y., 52 lamps; Hagerstown Municipal Plant, Hagerstown, Md., 117 lamps; Phillipi, W. Va., 20 lamps; Urbana Light, Heat & Power Company, Urbana, Ill., 78 lamps; New York, New Haven & Hartford Railroad, Hartford, Conn., 50 lamps; Hamilton Electric Light & Power Company, Hamilton, Ont., 200 lamps. The Northern Ohio Traction Company, of Akron, Ohio, has recently received 350 series A. C. lamps from this company, and has now ordered 350 multiple A. C. enclosed arcs.

A SHAH'S NECESSITIES.—The Shah of Persia, on leaving Paris, has bought 60 wheels and engaged 3 instructors and 2 repairers, and as soon as he returns, a Persian bicycle bodyguard 50 strong will be organized. After competitive trials of French, German and English makes, the Shah purchased all his wheels from an American bicycle company. The Shah has also bought 7 French naphtha automobiles of different sizes, 2 American Columbia electric automobiles, 100 telephones, 3 American phonographs, 10 American sewing machines, 1 French cinematograph and 20 cameras, including several instantaneous kodaks.

BUENOS AYRES, S. A.—The city of Buenos Ayres is lighted by means of 702 arc lamps, of which 315 are alternating and 587 continuous current. Besides these there are 13,597 gas, 8,553 kerosene, 8 incandescent and 8 naphtha lamps. The imports of electrical goods and apparatus, electric light, telegraph and telephone material into the Argentine Republic during the first quarter of 1900 amounted to $826,299 gold. The revenues of the tramways of the city of Buenos Ayres during the month of April, 1900, amounted to $1,111,681.63. Of this sum the municipality received $66,700.91.

ELECTRIC STORAGE BATTERY COMPANY.—On Aug. 5 the Electric Storage Battery Company, under protest, paid to the State of New Jersey, at Trenton, $3,600 as a fee for filing amended articles of incorporation. When the company was originally incorporated, with an authorized capital of $18,000,000, a fee of $3,600 was paid, and the officers of the company say that no charges should have been made for the filing of the amended articles. It is probable that the matter will go into court for adjudication as to the right of Secretary of State Wurts to charge a second fee.

W. G. CLARK & COMPANY, Seattle, Wash., are acting as the Northwestern representatives of several electrical concerns, etc., including the Edison-Brown Plastic Rail Bond, John A. Roebling's Sons Company and the Thos. Day Company. They are covering the territory embracing the States of Oregon, Washington, Idaho, Western Montana and British Columbia, visiting the various sections once a month. They will be glad to add some good agencies to their list in order to have a complete line, and would like to hear from manufacturers on the subject.

THE TEXAS ARM & PIN COMPANY, Beaumont, Tex., has recently increased its capital stock from $10,000 to $25,000, and is operating on full time four factories. It carries about 3,000,000 feet of seasoned long-leaf yellow pine lumber on hand for making cross-arms, and also a very large stock of arms in its sheds. The company has not yet been in business a year, but has shown great advance and has a tremendous demand. Its main office is at Beaumont, Tex., and the factories are located at Deweyville, Beaumont and Ruliff, Tex., and Leesville, La.

LIGHTING CITIES IN HAITI.—Minister Powell, writing from Port au Prince, informs the U. S. State Department that the Haitian Government has concluded to furnish light to its cities, and in future not to grant concessions for this work to others. The Government will cancel all concessions and pay the holders for their plants and for such amounts as have been expended by them. The Government also promises to introduce a system of electric lights for the capitol in the early fall.

MORRIN BOILERS—The Clonbrock Steam Boiler Company, of Brooklyn, N. Y., has received a contract for 16 500-hp Morrin Climax boilers for the Tube Steel Company's plant at Benwood, W. Va. It has closed its Chicago office in the Monadnock Building, Chicago, and in the future will transact all business from the Brooklyn office, 240 Lorraine Street, that city.

GREECE.—A concession for the electric lighting of the Euripus Canal, Greece, has been secured by the Société Hellénique d'Electricite, of Athens, which is now cutting out a good deal of work in Greece. It is proposed to utilize the current through the strait for this canal work, and special turbines will be needed.

TELEPHONE APPARATUS WANTED.—Mr. J. L. Haner, of London, O., informs us that he is in the market for poles, lines, cable, telephones, switchboards, tools, etc., for constructing a telephone exchange of 600 subscribers. He wishes to receive catalogues and lowest prices.

THE CHAMBLY MANUFACTURING COMPANY, of Montreal, is obtaining bids on four direct-connected alternating-current generators to be connected to turbines. Generators are to be of the polyphase type, of 2000-kw capacity.

Special Correspondence.

ENGLISH NOTES.

LONDON OFFICE, ELECTRICAL WORLD AND ENGINEER, Aug. 4, 1900.

GENERAL MEETING OF THE BRITISH THOMSON-HOUSTON COMPANY.—The fifth ordinary general meeting of the British Thomson-Houston Company, Ltd., was held recently at the offices, 83 Cannon Street, under the presidency of E. A. Lazarus, who said that the company was very full of orders, and among those in hand at the present time might be mentioned the following: Birkenhead, Blackburn, Bristol City tramways, Croydon, Dublin City tramways, Glasgow, Huddersfield, Hull, Leeds, London United, Newcastle, Queenstown lighting, Sheffield, Tynemouth, Isle of Thanet, and several other orders of a smaller description. At the company's works at Rugby satisfactory progress was being made, and he hoped that next time he had the pleasure of meeting the shareholders he would be able to tell them that the company was in active work there. As they were beginning to pay for part of the work they had decided to make a call of £2 10s. per share on the 1st of September, making £6 called up in all, and they would probably make the further call in two calls of £2 at intervals of two months, being the legal delay. The report was adopted, and the following resolution agreed to, viz.: "That the following dividends be now declared out of the net profits of the undertaking for the twelve months ending March 31, 1900, upon the capital issued on that date, viz.: On the £240,000 ordinary shares, fully paid, a dividend of 10 per cent for the year; on the £160,000 ordinary shares, of which £16,000 paid up from Aug. 15, 1899, a dividend at the rate of 10 per cent for the year; and that these dividends be paid on July 24, 1900."

THE NEW UNDERGROUND RAILWAY which the Central London Railway has opened to traffic this week has proved to be a great success, and all London seems to be as pleased with its latest novelty as a child would be with a toy. During the first day there were no fewer than 84,500 passengers who traveled by the new line, and thousands more stood about the stations and looked on. The universal verdict has been in favor of the new road, which has already been nicknamed the "Twopenny Tube." The simplicity of the arrangements is also greatly appreciated. The system of purchasing tickets and dropping them in "chopper" boxes at the gate, in the same manner as is done on the elevated roads in New York, is an absolute novelty to the public in this city. It is a system, however, which is already favorably commented upon. The luxuriance of the cars has also called for many remarks, and one can hear on all sides favorable criticisms as to the lighting, the ventilation, the elegance, the comfort and the general pleasantness of the motion of traveling in this underground tunnel. For those who have to travel long distances, also, the price of 4 cents commends itself most favorably, as the omnibus fare for the same distance amounts to 10 cents. The first day passed off with the greatest success, and everything worked as smoothly as if the road had been running for years. The public, however, did not know that for the past three weeks the directors have been running experimental trains at schedule time, with the whole force of employees attending to the work, just as if the road were open for traffic. In this way, therefore, when the road was thrown open, everything started off with the greatest smoothness, and each employee knew exactly what was expected of him. After a period of extreme heat in London, when the thermometer has been averaging 90 degs. for the past week or two, the deliciously cool atmosphere of the tunnel has proved most grateful, the temperature being always in the vicinity of 55 degs. It may not be out of place to recall at this time that it is just 10 years since the scheme was first promulgated, the application having been made to Parliament in 1890. Since that time many of the most able and experienced engineers and business men who are familiar with railway business have been devoting continuous thought to the successful accomplishment of this railroad. The company was actually floated in June, 1895, and the first operation was the sinking of the shaft at Chancery Lane, in August, 1896. The cost of the double tunnel has been about £585,000 per mile, so that for the whole road the cost has been about £3,500,000. The line, as is well known, starts at the Bank and goes to Shepherd's Bush, and is underneath great public thoroughfares throughout the entire length, being directly underneath Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater Road and Uxbridge Road. The journey by omnibus used to take one and a quarter hours, and as the running time on the underground road is only 25 minutes, it will be seen what advantages it possesses, especially when you can travel the whole distance for less than one-half the 'bus fare. It looks as if the Central London Railway were destined to have a great success, and, judging from the number of passengers who traveled during the first day, which, at the same rate, would be a yearly passenger return of 30,000,000, it looks as if it were quite possible that the estimated passenger traffic expected by the company of 50,000,000 would be soon realized.

General News.

THE TELEPHONE.

ALBANY, N. Y.—The Glen Telephone Company of Montgomery County has increased its capital stock from $10,000 to $100,000.

SAGINAW, MICH.—The Michigan Telephone Company has begun the construction of its long-distance lines between Saginaw and Ludington.

SNOW HILL, MD.—The Sinepuxent Telephone Company, of Berlin, has completed its line to Snow Hill and is connected with the Snow Hill central.

CENTRALIA, MO.—J. A. Chance, A. B. Chance, H. S. Booth and others have incorporated the Centralia Telephone Company, with capital stock of $6,000.

BOSTON, MASS.—The Martha's Vineyard Telegraph Company has been incorporated in Boston. Capital, $10,000. Incorporators: G. C. Maynard, A. Lord, H. Morris.

WORCESTER, MASS.—It is probable that a union of the Massachusetts Telephone and Telegraph Company and the Citizens' Telephone Company of Worcester will be perfected.

DENTON, MD.—In consequence of a movement headed by Harry A. Richardson, of Dover, Del., it is probable that all the towns on this peninsula will very soon be connected by telephone.

ST. JOHNSBURY, VT.—The Citizens' Telephone Company, which is quite a competitor of the New England Company in Orleans County, is extending its service to St. Johnsbury and Wells River.

COLUMBUS, OHIO.—The Cedarville Telephone Company has been incorporated. Capital, $15,000. Incorporators: D. Bradfute, O. E. Bradfute, J. H. Andrew, F. B. Trumbell, S. B. Rankin.

FALLS CHURCH, VA.—The Falls Church Telephone and Telegraph Company has been chartered. Capital, $5,000. Incorporators M. E. Church, B. E. Williams, E. J. Northrup, all of Falls Church.

KINEO, ME.—The Kineo and Northeast Carry Telephone and Telegraph Company is extending its new line to the head of Chesuncook lake, fifty miles into the wilderness of Maine. The work will be completed by Aug. 20.

STURGEON, MO.—The New Century Telephone Company, of Sturgeon, has been incorporated. Capital, $10,000. Incorporators: O. D. Gray, W. Seymour, both of Sturgeon; T. R. Morris, S. P. Hulin, T. D. Sayre, all of Clark.

SHEFFIELD, ALA.—The Cumberland Telephone Company is now putting in a line between Sheffield and Tuscumbia. A gap of two or three miles is to be filled between Sheffield and Memphis. The line will be extended on to Florence and other points north.

CHICAGO, ILL.—It is stated that the Santa Fé Railway Company is considering the substitution of the telephone for the telegraph on its system. The advocates of the telephone claim that that instrument is less liable to cause mistakes than the telegraph.

RICHMOND, VA.—The Southern Bell Telephone Company will take an appeal from the decision of the United States Circuit Court of Appeals, in which it was decided that the company had no rights in Richmond under the State statutes or municipal ordinances.

HONEOYE, N. Y.—The People's Telephone Company of Ontario County, has completed arrangements for the extension of the line from Canandaigua to Hemlock via Honeoye. Connection will then be made with the independent company of Rochester and Monroe County.

SAN FRANCISCO, CAL.—The Pacific Coast Telephone and Telegraph Company has disincorporated and its property has been sold to another corporation, the Pacific States Telephone Company. Its executive offices will be in Portland, Ore. This step was taken on account of the assessments of the company's franchise in this city.

SUSQUEHANNA, PA.—At a meeting of the stockholders of the Susquehanna Valley Telephone Company, of Pennsylvania, Joseph F. Lannon was elected president, R. J. Manning, secretary and treasurer. Directors were elected as follows: Joseph F. Lannon, John Ferguson, Frank Zeller, H. S. Williams, M. J. Lannon and C. E. Titsworth. The company will at once apply for a charter.

ELECTRIC LIGHT AND POWER.

JACKSONVILLE, FLA.—The city is considering the enlargement of its electric-light plant.

HOUSTON, TEX.—The city will build an electric-light plant. Address Arthur Lipper, City Clerk.

AIKEN, S. C.—The Carolina, Light and Power Company has increased its capital stock from $20,000 to $50,000.

ALBANY, N. Y.—The Bath Electric and Gas Light Company has been incorporated with a capital of $100,000.

OPELIKA, ALA.—It is reported that the Opelika Electric Light and Power Company will change the location of its plant.

EVERGREEN, ALA.—The city will build a $25,000 electric-light plant and water-works. Address, T. D. Jackson, City Clerk, for further particulars.

DAYTON, KY.—The Dayton Electric Light and Power Company has been chartered, with a capital stock of $50,000, by W. A. Wadsworth and others.

DALTON, FLA.—The city has purchased the gas plant of the Dalton Gas and Electric Light Company and will erect an electric-light plant next year. For further particulars address the Mayor.

SPRINGFIELD, ILL.—The Jerseyville Light, Heat and Power Company has been incorporated. Capital, $25,000. Incorporators: G. D. Rosenthal, O. Ferd, Josephine Rosenthal, all of Jerseyville.

ROCHESTER, N. Y.—The Genesee Electric Company, of Rochester, has been incorporated. Capital, $50,000. Incorporators: W. A. Boland, of New York City; F. C. Cochen, P. A. Flynn, both of Brooklyn.

FRANKFORT, KY.—Incorporation articles have been filed by the Dayton Electric Light and Power Company of Campbell County, with $50,000 capital. H. A. Wadsworth and H. M. Stegeman are at the head of it.

KIRKWOOD, MO.—It has been decided by popular vote to issue the $17,000 of bonds for construction of the city's proposed electric-light plant. Plans and specifications will be received. Address communications to the Mayor.

RICHMOND, VA.—The work on the power-house of the Virginia Electrical Railway and Construction Company, along James River, is progressing rapidly. This will be the largest electric power-house in the city when completed.

ABINGDON, VA.—The Abingdon Water and Light Company has been chartered. Capital, $25,000. Incorporators: H. E. McWane, of Lynchburg; G. W. Palmer, of Sailville; R. M. Page, F. B. Hurt, J. I. Hurt, all of Abingdon.

CATTARAUGUS, N. Y.—The Cattaraugus Electric Light and Power Company of Cattaraugus has been organized. Capital, $12,000. Incorporators: A.

J. Setter, of Collins Center; F. Crawford, H. P. Bishop, both of Cattaraugus; H. P. Bishop, attorney, Cattaraugus.

BIRMINGHAM, ALA.—The Irondale Water, Light and Power Company has organized and secured the necessary franchises to build and operate waterworks and lighting systems to supply all the suburbs and intervening territory from Birmingham to Irondale. R. R. Zell is the engineer.

PITTSBURG, PA.—The dynamos and engines, which the Westinghouse Electric and Machine Companies furnished for the newly erected passenger station of the Pittsburg & Lake Erie Railroad, have now been placed in position, and it is expected that the electric plant, as well as the refrigerating plant, will be in operation within ten days.

THE ELECTRIC RAILWAY.

PHILADELPHIA, PA.—The Philadelphia and Jersey City trolley road is now an assured fact.

JACKSONVILLE, FLA.—The Jacksonville Street Railway Company has been granted a franchise in this city.

BRADFORD, PA.—The Bradford Traction Company has filed articles of incorporation. The capital stock is $1,000,000.

JACKSONVILLE, FLA.—Another proposition to build an electric railway in the city has been made by W. B. Owen and others.

LOUISVILLE, KY.—The Louisville Railway Company has secured a franchise to build an electric line along Frankfort Avenue.

UNION, S. C.—Capitalists have offered to construct an up-to-date electric railway at Union, connecting the city and suburban mills.

CHATTANOOGA, TENN.—The Chattanooga Rapid Transit Company will rebuild its $30,000 power house which was recently burned.

BALTIMORE, MD.—At a stockholders' meeting of the Newport News, Hampton and Old Point Railway and Electric Company, the capital stock was increased $200,000.

COLUMBUS, O.—The Germantown Traction Company has increased its capital stock to $450,000, and the Cincinnati Street Railroad from $18,000,000 to $20,000,000.

LITTLE ROCK, ARK.—It is announced that the City Council will advertise for bids for improving the present street railway line and constructing extensions. A. D. Adams is chairman of the railroad committee.

BRIDGEPORT, OHIO.—The Bridgeport and Cadiz Interurban Railroad Company has been incorporated. Capital, $10,000. Incorporators: C. H. Taney, A. B. Butler, W. W. Meek, J. A. White, E. L. Finley.

DAYTON, OHIO.—The Dayton, New Carlisle and St. Paris Traction Company, capitalized at $1,350,000, was incorporated by B. H. Rannells, H. S. Forgy, Charles E. Layton, Harrie N. Reynolds and John A. Brake.

NORTH ANDOVER, MASS.—The Board of Selectmen has granted two new street railway franchises, one to the Lawrence & Salem Street Railway Company and one to the Haverhill & Andover Street Railway Company.

FRANKLIN, PA.—The Venango Traction Company, of Franklin, has been incorporated. Capital, $50,000. Incorporators: J. B. Smithman, L. M. Davison, J. S. Coover, L. Milton, J. Fox, J. H. Forbush, all of Oil City.

CHATTANOOGA, TENN.—The North Side Consolidated Street Railroad Company has been organized in this city. Capital, $100,000. Incorporators: S. W. Divine, W. B. Royster, E. D. Lilly, C. D. Divine, J. B. Sevier, all of Chattanooga.

TRENTON, N. J.—The New Jersey & Philadelphia Street Railway Company, which is backed by Boston capitalists, has secured the upper Delaware River bridge in this city, and expects to be running cars from this city to Philadelphia by Jan. 1 next.

NORFOLK, VA.—The Portsmouth Street Railway has been sold by Philadelphia capitalists to R. Lancaster Williams, of Richmond; Gustavus Ober, of Baltimore, and H. L. Maynard, of Portsmouth, for $500,000. The property will be greatly improved.

PORTSMOUTH, VA.—Philadelphia capitalists have purchased the Portsmouth Street Railway for about half a million dollars. The bonded indebtedness of the road is only some $242,000, and its capital stock does not exceed $125,000. It has a large earning capacity.

CHICAGO, ILL.—Federal Judge Kohlsaat has given Receiver Henrotin, of the Chicago Electric Traction Company, the privilege to change the road from a storage battery to an overhead trolley. Authorization was granted to issue $250,000 of receiver's certificates for the installation of the trolley system.

THE AUTOMOBILE.

LA PORTE, IND.—The Munson automobile plant of this city has resumed operation. Vehicles of the most modern pattern will be turned out.

THE REMINGTON AUTOMOBILE MOTOR COMPANY has been organized in Orange, N. J., to manufacture gasoline, electric and other motors and automobiles. Capital, $250,000. Incorporators: C. E. Remington, of New York; C. B. Storrs, W. A. Lord, both of Orange, N. J.

AUTOMOBILE NOTES.—Several members of the automobile clubs of America have lately returned home from their visit to the Paris Exposition, and that they were impressed with the French automobiles is evidenced by the fact that half a dozen or more French vehicles have made their appearance on Riverside Park in New York. Mr. A. C. Bostwick, one of the automobile pioneers of America, brought back with him no less than five new automobiles, among them being the French carriage that made the record in the Lyons-Marseilles race. Mr. C. J. Field secured for himself and a few friends six De Dion voiturettes, and many other gentlemen are bringing back several Parisian fancies. The approaching automobile season promises to be an unusually active one, and the various committees of the Automobile Club of America are already engaged in planning runs, tests, entertainments and exhibits that will keep the close attention of the members until the end of the year. The outlook for the automobile exhibition to take place in Madison Square Garden Nov. 3 to Nov. 10 next, is said to have already been successful beyond all expectations. In order to meet the demands for space, a long row of boxes in the garden has been sacrificed, but yet this is not enough; the only possible way now to provide sufficient space is to reduce the size of the track, but this will not likely be resorted to, because the running tests of the automobiles will be a feature of the exhibition.

NEW INDUSTRIAL COMPANIES.

THE NATIONAL TELEPHONE EQUIPMENT COMPANY, of Detroit, Mich., has been incorporated with a capital stock of $100,000.

THE UTICA FIXTURE COMPANY, Utica, N. Y., has been incorporated. Capital, $12,000. Incorporators: W. S. French, of New Hartford; E. J. Millspaugh, A. G. Sieboth, both of Utica.

SIDNEY, N. Y.—The Susquehanna Valley Electric Company, of Sidney, has been incorporated. Capital, $200,000. Directors: H. B. Oakman, Brooklyn; C. F. Lehman, Smithtown, L. I.; C. C. Higgins, Bedford.

THE BELDEN-LARWILL ELECTRIC SUPPLY MANUFACTURING COMPANY, of Fort Wayne, Ind., has been incorporated and filed articles of association. The company will manufacture electrical supplies of all kinds.

LEGAL.

AUTOMOBILE SUIT.—The Electric Vehicle Company has brought suit against the Winton Gasoline Carriage Company and the Buffalo Gasoline Engine Company, claiming that it owns the original patents covering all forms of gasoline carriages. Manufacturers of gasoline vehicles are deeply concerned in the case, since, if the court allows the claims of the Electric Vehicle Company, they will be practically driven out of business. The case will probably come up for trial late in the fall or in the early winter. The patents in question are those of George B. Seldon, granted Nov. 5, 1893, and by him sold to the Columbia and Electric Vehicle Company, which concern afterwards sold its rights in the patents to the Electric Vehicle Company. A meeting was held in Buffalo, N. Y., on Aug. 2, for the purpose of forming an association to fight the Seldon patents. The organization was effected and officers duly elected, and the meeting was adjourned subject to the call of the executive committee. The president is Mr. Elmer Apperson, of Kokomo, Ind., and the secretary is Mr. Geo. H. Brown, of the Winton Motor Carriage Company, Cleveland, Ohio. It is stated that the organization will stand by the Winton and Buffalo companies in their fight with the Electric Vehicle Company.

OBITUARY.

SIEMENS.—The death is announced of Mr. Werner von Siemens, son of Carl von Siemens. He was not known in this country, and is said to have been quite a young man.

JAMES HEMPHILL, president of the Mackintosh-Hemphill Company, builders of steam engines, died at his home in Pittsburg recently. Mr. Hemphill was well known as an inventor of numerous improvements to the steam engine.

MR. HENRY REASON.—A great many electrical engineers in this country will regret to hear that Mr. Henry Reason has been killed by a fall from his horse while traveling in Australia on a business and pleasure trip with Mr. Arthur Wright, the inventor of the Wright meter. The deceased visited this country in 1897 and made a number of friends here. He was an able business man and a most agreeable companion, and his death is regarded as a great loss to the electrical industry in England.

PERSONAL.

MR. GEORGE A. MANSFIELD, of the Michigan Electric Company, Detroit, Mich., paid Chicago a visit last week on business affairs.

MR. S. G. DECOURSEY.—The directors of the American Railways Company have elected as president, vice A. A. McLeod, resigned, Mr. S. G. Decoursey, who was formerly president of the Western New York & Pennsylvania. He assumes his new duties at once.

MR. HERBERT W. SMITH has accepted a position with the Stuart-Howland Company, of 283 Devonshire Street, Boston, as assistant manager of its railway department.

MR. RICARDO HARDMAN, a representative of the Westinghouse Company at San Luis Potosi, Mexico, was in Pittsburg recently on business connected with his company.

MR. A. O. FOX, of the Northern Electric Manufacturing Company, of Madison, Wis., has been in New York City recently on important matters connected with the Northern-Stanley combination, reference to which was made in these pages last week.

WEAVER—NIEBUHR.—The marriage is announced, in Germany, of Mr. W. D. Weaver, editor of the ELECTRICAL WORLD AND ENGINEER, to Miss Mildred E. Niebuhr, of Bremen. The happy pair will visit the Paris Exposition during August, and spend September at Sorrento, Italy.

MR. C. T. BOYNTON, until recently a director and chief of the sales department of the American Steel & Wire Company, has been elected president of the Shelby (Ohio) Steel Tube Company. Mr. A. M. Crane, formerly assistant general manager of the American Steel & Wire Company, will be identified with the Shelby Company. The company's general offices will soon be moved either to New York or Chicago, probably New York.

Trade Notes.

THE BROOKS-FOLLIS ELECTRIC CORPORATION recently moved its office and storerooms to 527 Mission Street, San Francisco.

CROSS OIL FILTERS.—The Burt Manufacturing Company, Akron, Ohio, has just equipped the Elgin National Watch Company, Elgin, Ill., with Cross oil filters.

INTERIOR CONDUITS.—The Western Electric Company carries a complete stock of Sprague, Greenfield and Loricated conduits in Chicago stock, which can be sold at the lowest market prices.

THE CROUSE-HINDS ELECTRIC COMPANY of Syracuse, N. Y., has been incorporated with a capital of $10,000. The directors are H. B. Crouse, J. L. Hinds and J. A. Hopper, of Syracuse.

AUTOMOBILE BELLS.—The Frank Mossberg Company, Attleboro, Mass., has issued a preliminary catalogue of its automobile and carriage bells. The various styles of bells are illustrated, and their special features briefly described.

BRANCH OFFICE.—The General Incandescent Arc Light Company, New York, has opened a branch office at 57 Perin Building, Cincinnati, Ohio, which will be in charge of Mr. F. C. Colwell, who has heretofore covered the Cincinnati business from the Cleveland office.

GRAPHITE.—The John Dixon Crucible Company, Jersey City, N. J., has just issued an eight-page pamphlet giving considerable information regarding graphite facings for moulding work. A graphite face prevents adhesion of the metal to the sand of which the mould is composed.

YURGAE SIGNALPHONE.—O. P. Yurgae and R. H. Yurgae have recently taken out a patent on a new form of electric signal registering system for keeping tab on telephone calls, etc. The patent has been assigned to the Yurgae Signalphone Manufacturing Company, of Milwaukee, Wis.

ENLARGING WIRE PLANT.—The Washburn Wire Company is enlarging its plant at Providence, R. I. The first building to be erected will be 300 ft. x 90 ft., two stories high, and will be of iron. The furnace building will be 160 ft. x 90 ft., and will joint the main structure. Plans for other buildings are under way.

POLYPHASE INDUCTION MOTORS.—The Westinghouse Electric and Manufacturing Company, in Circular No. 1029, recently issued, describes its type "C" polyphase induction motors for constant speed. The principal parts of this machine and the machine complete are illustrated in half-tone cuts, and various tables give dimensions of the machines.

DIESEL HEAT ENGINE.—We are informed that the Diesel heat engine, which has been fully described in this paper, has been awarded the "Grand Prix" in the class of gas and petroleum motors at the Paris Exposition. This is the highest award that could be given, and it shows the important place which the Diesel engine is acknowledged to hold in the field of gas and petroleum motors.

THE SYRACUSE ARC LAMP COMPANY, of Syracuse, N. Y., has recently opened a branch office at 26 Cortlandt Street, New York. It is in charge of Mr. B. N. Sperry, vice-president of the company, who will take care of the sales of their new arc lamp in Greater New York. The office will also be headquarters for the Davis incandescent lamp, for which Mr. Sperry is agent, in the same territory.

ONONDAGA GENERATORS AND MOTORS.—A neat and attractive pamphlet has just been issued by the Onondaga Dynamo Company, Syracuse, N. Y., describing and illustrating its line of generators and motors for lighting and power work. The constituent parts of the machines, and the machines complete are illustrated by half-tone cuts, and tables of dimensions, weights, etc., are given.

THE COLONIAL ELECTRIC COMPANY, of Ravenna, O., is making more Orient incandescent lamps than ever, and urges its claims as independent manufacturers upon the consumer. The Colonial Electric Company, as successor to the Orient Company, has inherited not only its business, but its policy, and is taking a bolder and more determined stand than ever in its pursuance, as will have been noticed.

POLES AND TIES.—Midsummer is usually a dull time for dealers in poles, ties, etc., but Messrs. W. C. Sterling & Son, Monroe, Mich., report a good business, and state that they are shipping cedar poles and ties as fast as the railway company can furnish cars. The firm has eleven sorting yards, in all of which they are busy. They have been in the cedar business for over 25 years, and during that time they have won the confidence of the entire trade. The firm is now filling contracts with several large electric railway companies for poles and ties, and has a very large stock on hand for the fall trade.

THE CHICAGO MICA COMPANY, whose main office is at its factory, Valparaiso, Ind., attributes the enormous increase in sales of its products in the Central and Western States to the fact that manufacturers and other consumers of insulating materials appreciate being able to deal directly with the manufacturers. The thorough equipment and organization of its factory, together with its location, only 40 miles from Chicago, on three of the great trunk lines of railway, enable this company to make delivery of its products in less than one-half the time ordinarily required. Its well-known Micabond products are fast becoming standard throughout the United States.

STUART-HOWLAND CO.—Although in the business less than a year, the Stuart-Howland Co., of Boston, Mass., reports a steady and substantial gain, from month to month, in its electrical supply trade. It has secured the exclusive agency of several well-known electrical manufactures, and handles the best line of electrical supplies that there is on the market. One evidence of its activity and push is that it employs six salesmen constantly on the road. Orders are promptly filled and carefully attended to. It has recently added a street railway supply department, in charge of Mr. Herbert W. Smith, who has had extensive experience in the street railway supply business and is well known to the electrical trade.

GENERAL ELECTRIC BULLETINS.—Recent additions to the General Electric Company's trade literature consist of Bulletins Nos. 4220, 4221, 4226 and 4227. No. 4220 describes and illustrates automatic circuit breakers, form CD, for 125 and 250-volt direct-current circuits; No. 4221 relates to the GE-54 railway motor; No. 4226 to continuous current railway switchboards, and No. 4227 to the CE motor. Catalogues and price lists Nos. 7527 and 7528 have also just been issued; the former is of the parts of Brush arc generators, and the latter, parts of carbon feed, enclosed arc lamps, for 110-volt direct-current circuits. Every part has a number of its own, so that it is an easy matter to order a part or parts by telegraph, by simply referring to their numbers.

THE DEDION BOUTON MOTORETTE COMPANY, of Thirty-seventh Street and Church Lane, Brooklyn, N. Y., manufacturer of the DeDion Bouton motors, under license from the DeDion Bouton Company of France, has in stock a number of parts for changing over any of the small size (1¾ horse-power) air-cooled motors to 2¼ horse-power. All that is necessary is a new cylinder, piston and cylinder head with valves. This exchange is made by the DeDion Bouton Motorette Company at a very moderate price, and any who have tricycles or quadricycles with these small motors would do well to communicate with the Motorette Company and try to arrange to get the parts to enlarge their motors, as the results they could obtain would be much more satisfactory to them, especially on steep grades. The Motorette Company also carries a full line of supplies for the DeDion motor, parts, batteries and other fittings.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED AUG. 7, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

655,176. ELECTRIC ARC LAMP; J. F. Ackermann, New York, N. Y. App. filed Oct. 20, 1899. To avoid consumption of the electrodes a fuel is supplied to them by forcing it through a central passage in the upper electrode to the arc space.

655,203. TELEGRAPHIC TRANSMITTER AND RECEIVER; A. C. Crehore, Hanover, N. H., and G. O. Squier, Fortress Monroe, Va. App. filed June 7, 1899. One object of this invention is to construct an apparatus which will be adapted to transmit messages from sheets wherein they have been perforated in lines transversely of the sheet, thus dispensing with the inconvenient tape.

655,216. SWITCH FOR SUSPENDED ELECTRIC CONDUCTORS; J. Floyd, Washington, D. C. App. filed Dec. 8, 1899. The switch comprises a single piece of wire having arms extended integral therewith and curved into the form of a loop, thus affording a space for the accommodation of the flange of the trolley wheel when it passes the switch.

655,217. CROSSING FOR SUSPENDED ELECTRIC CONDUCTORS; J. Floyd, Washington, D. C. App. filed Dec. 8, 1899. A modification of the preceding.

655,219. SYSTEM OF ELECTRICAL DISTRIBUTION; E. E. Frischmuth, Berlin, Germany. App. filed Oct. 2, 1899. In order to keep a uniform tension upon a suspended conductor and to ensure grounding it in case it is broken, one end of the conductor carries a suspended weight.

655,237. APPARATUS FOR TRANSFORMING ALTERNATING CURRENTS INTO CONTINUOUS CURRENTS, AND VICE VERSA; M. Hutin and M. Le Blanc, Paris, France. App. filed April 28, 1899. A principal object of this invention is to transform a monophase alternating current into a unidirectional continuous of uniform intensity without the necessity of using condensers. The apparatus comprises magnetic cores, secondary windings thereon for supplying the continuous current leads, a primary circuit on one of the cores connected to the alternating current leads and an inductor, moving with reference to the other core and arranged to supply the electrical energy of transformation.

655,238. PROCESS OF TRANSFORMING ALTERNATING CURRENTS INTO CONTINUOUS CURRENTS, AND VICE VERSA; M. Hutin and M. Le Blanc, Paris, France. App. filed April 28, 1899. The process carried out by the apparatus covered in the preceding patent.

655,239. PROCESS OF BLEACHING BY ELECTROLYTIC CHLORINE WATER; T. Jespersen, Neenah, Wis. App. filed May 29, 1899. The process consists in electrolyzing a dilute watery solution of hydrochloric acid, allowing the chlorine gas liberated at the immersed anode to dissolve in the water of said solution, bleaching with the resulting chlorine water, and by the act of bleaching restoring hydrochloric acid to the solution and again electrolyzing as before.

655,243. FUSE BLOCK; L. A. Keith, Mansfield, Ohio. App. filed Sept. 11, 1899. Details.

655,249. TELEGRAPHIC TYPEWRITER; R. Kubler, Berlin, Germany. App. filed Aug. 29, 1898. Electric impulses produced by means of a contact bar and metallic pointer forming the centre are transmitted to the receiving apparatus and produce the rotation of a typewheel, the type of which, after being adjusted to the printing position, is caused to effect the impression at the moment a somewhat longer electric impulse is effected at the sending end.

655,264. SIGN OR SIGNAL FOR CALLING CABS; A. G. R. Nichol, New York, N. Y. App. filed Sept. 1, 1899. An electric sign provided with numbers, any one of which can be illuminated by manipulating a switchboard.

655,265. ELECTRIC CABLE; G. H. Nisbett, Huyton, England. App. filed Dec. 28, 1897. The conductor is wound longitudinally with an insulating

strand triangular in cross section, and the usual protecting sheathing is placed around this.

655,266. ELECTRIC ARC LAMP; J. S. Nowotny, Madisonville, Ohio. App. filed July 12, 1898. The upper carbon is fed by an axial magnet, and the invention consists in introducing a rheostat between said magnet and the upper end of the outer globe.

655,268. ELECTRIC MOTOR; E. G. P. Oelschlager and C. O. F. Schrottke, Berlin, Germany. App. filed December 27, 1897. To prevent sparking when the motor is cut out of circuit there is provided a secondary path through the starting resistance for the extra current.

655,276. MEASURING INSTRUMENT; F. Schrottke, Berlin, Germany. App. filed Nov. 18, 1899. Briefly speaking, this invention consists of means wherein the current traversing one circuit is combined with the geometrical sum of the pressures impressed upon two of the circuits of the system.

655,279. WINDING MACHINE; B. A. Stewart, Pittsfield, Mass. App. filed Nov. 28, 1899. This is a machine for winding tape upon an endless form such as the coil of a transformer.

655,317. ELECTRIC TEMPERATURE INDICATOR; L. S. Wilder, Springfield, Mass. App. filed Nov. 18, 1899. Details.

655,335. MOTOR STARTER; E. M. Fraser, San Francisco, Cal. App. filed March 11, 1899. Improvements in the details of construction of an automatic starting box.

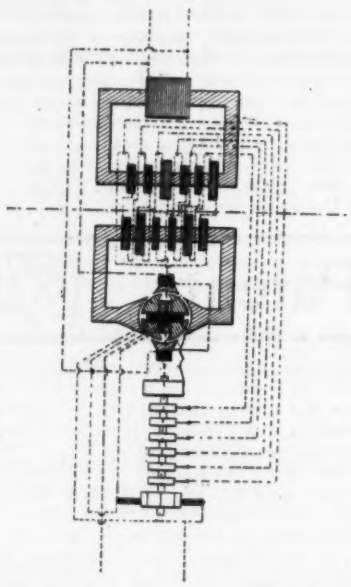
655,336. CONTROLLER; E. M. Fraser, San Francisco, Cal. App. filed July 20, 1899. A construction whereby the circuits can be completed or interrupted only when conditions that have been previously determined upon have been complied with.

655,340. STARTING DEVICE FOR ELECTRIC MOTORS; J. H. F. Gorges, Berlin, Germany. App. filed Dec. 31, 1897. The armature of the motor has a multiphase winding, comprising a plurality of divisions for each phase. In connection with this, means are provided for changing the connections of the divisions to vary the effective electromotive force.

655,341. SYSTEM OF ALTERNATING CURRENT TRANSMISSION; J. H. F. Gorges, Berlin, Germany. App. filed Oct. 11, 1899. The motor has a plurality of energizing windings, a Wheatstone bridge for effecting the phase adjustment of the windings and a secondary circuit in inductive relation with a winding of the Wheatstone bridge and including a condenser.

655,343. ELECTROLYTIC CELL; J. Hargreaves, Widnes, England. App. filed Jan. 31, 1899. For use in the manufacture of alkalies by electrolysis, an electrolytic cell having a series of inwardly and downwardly inclined metal strips formed with serrations on their lower edges arranged in the cation chamber and extending from the outer or cover plate of the cell to the surface of the cathode.

655,344. CATHODE FOR USE IN ELECTROLYTIC CELLS; J. Hargreaves, Widnes, England. App. filed Jan. 31, 1899. A woven wire cathode having



655,237.—Apparatus for Transforming Alternating Currents into Continuous Currents, and Vice Versa.

the prominent parts of its surface where the wires cross one another flattened so as to make more intimate contact with a porous diaphragm against which it is placed.

655,353. METER; C. O. F. Schrottke, Berlin, Germany. App. filed Dec. 27, 1897. Means are provided for producing a torque for counteracting the friction, an adjustment being also provided whereby the torque may be made equal in force to the friction which may vary in different meters.

655,368 ELECTRIC BATTERY; C. E. O'Keenan, Paris, France. App. filed Dec. 30, 1897. A battery in which the atmosphere is utilized as a depolarizing agent.

655,389. SAFETY DEVICE FOR ELECTRIC VEHICLES; F. E. Case, Schenectady, N. Y. App. filed May 20, 1899. In case the motorman removes his hand from the lever of the controller an automatic device shuts off the power.

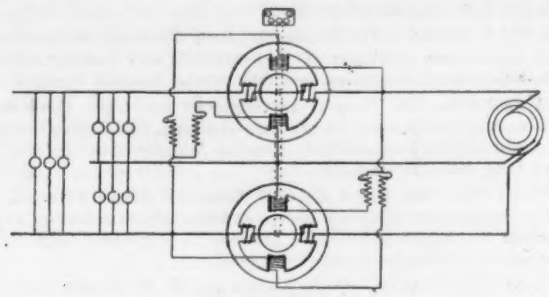
655,411. ELECTRICAL DETECTOR FOR HEAT OR COLD; J. O'Meara, New York, N. Y. App. filed May 12, 1899. A weight is suspended from a wire and carries contact points which are caused to make and break a circuit by the expansion or contraction of the wire.

655,412. CIRCUIT CLOSER; J. O'Meara, New York, N. Y. App. filed May 20, 1899. A modification of the preceding.

655,413. MAGNETIC DRINKING CUP; H. A. Parkyn, Chicago, Ill. App. filed Oct. 20, 1899. For medical purposes a drinking cup is provided with magnets so arranged as to bring the liquid into the magnetic field and to make to any one using the cup a health-giving suggestion of electricity and magnetism.

655,427. BURGLAR OR FIRE ALARM; F. D. Wallace, Wheatland, Ind. App. filed Oct. 20, 1899. Details.

655,433. MAGNETIC SEPARATOR; C. F. Courtney and R. Butterworth, Broken Hill, N. S. W. App. filed March 19, 1900. The comminuted ore or



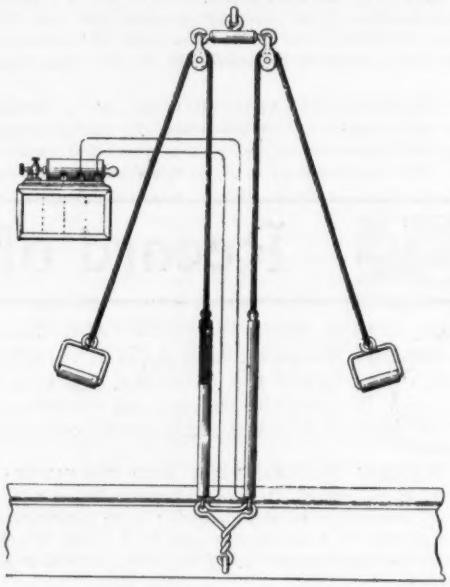
655,276.—Measuring Instrument.

other mixture is caused to pass through a highly-concentrated magnetic field in the form of a thin film, so as to avoid risk of the paramagnetic particles becoming prematurely detached from the magnetic poles and swept away by contact with the passing stream of matter of lower magnetic permeability with which they are associated.

655,455. ELECTRIC RAILWAY; W. B. Purvis, Philadelphia, Pa. App. filed April 24, 1900. A closed conduit having its upper side composed of non-magnetic and non-conducting material, a flexible main feeder in the conduit, terminals in the conduit adapted for contact with the feeder, a contact rail connected with the terminals and a magnet carried by the vehicle for creating contact between the feeder and the terminals.

655,491. ELECTRICALLY DRIVEN MACHINE; T. H. Josephs and J. J. Ehrenreich, New York, N. Y. App. filed Jan. 27, 1899. Details of a treadle arrangement adapted for starting and stopping a motor.

655,526. ELECTRIC ARC LAMP; T. Spencer, Philadelphia, Pa. App. filed May 14, 1900. The invention comprises a dash pot so constructed that the full braking effect thereof is automatically secured in opposition to any sudden movement of the lamp carbon, the relation of the parts being such,



655,671.—Electric Conductor for Exercising Apparatus.

however, that no braking effect whatever is opposed to the normal regulation of the lamp.

655,563. ELECTRIC CARRIAGE; Chas. A. Lindstrom, Chicago. App. filed March 3, 1900.

655,620. TELEPHONIC APPARATUS; Alfred Graham, London, England. App. filed Oct. 17, 1898.

655,651. MULTIPLEX TELEPHONY; Ernest A. Faller, San Francisco, Cal. App. filed April 28, 1900.

655,671 ELECTRIC CONDUCTOR FOR EXERCISING APPARATUS; A. M. Crooker and F. M. McDonald, Boston, Mass. App. filed March 10, 1900. An exercising apparatus consisting of stretching cords passing over pulleys is provided with electrical conductors arranged to pass a current through the body of the person exercising.

655,677. PHOTOGRAPHIC RECORDING APPARATUS FOR VIBRATORY RAYS OF LIGHT; A. Pollak and J. Virag, Budapest, Austria-Hungary. App. filed Dec. 14, 1899.